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EDITORIAL

LOW-TOXICITY ANTHELMINTHICS

Intestinal helminths are widespread amongst tropical children, and, of these, the roundworm and the hookworm are the most important. The incidence and, more significantly, the public health importance of strongyloidiasis and whipworm infection are uncertain in many regions, although in some places the latter has been shown to be a not uncommon cause of dysenteric features and sometimes to produce rectal prolapse.(1) Taeniasis has, as would be expected, a much more circumscribed geographical distribution, depending upon whether beef or pork are forbidden or not, and, in addition, on the fact that relatively little meat of any type will usually be available to the tropical child.

Although the problems of ascariasis and ancylostomiasis must ultimately be solved by such preventive measures as improved health education, the installation and use of simply constructed cheap latrines etc., the need for inexpensive non-toxic anthelminthics has also long been felt, both for the treatment of clinical cases as well as forming part of the preventive campaign.

Until recently the drugs available for the treatment of ascariasis, such as oil of chenopodium and santonin, were both somewhat toxic and needed special preparation and purgation. However, in recent years these have been increasingly superseded by piperazine compounds, including the citrate and adipate. This drug, either in syrup or tablet form can be given with no preparation or purgation in a single-dose of 70 mgm./lb. body weight (maximum 3 gm.), which can be repeated after two weeks.(2) This regime has also been

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Although the problems of ascariasis and ancylostomiasis must ultimately be solved by such preventive measures as improved health education, the installation and use of simply constructed cheap latrines etc., the need for inexpensive non-toxic anthelminthics has also long been felt, both for the treatment of clinical cases as well as forming part of the preventive campaign.

Until recently the drugs available for the treatment of ascariasis, such as oil of chenopodium and santonin, were both somewhat toxic and needed special preparation and purgation. However, in recent years these have been increasingly superseded by piperazine compounds, including the citrate and adipate. This drug, either in syrup or tablet form can be given with no preparation or purgation in a single-dose of 70 mgm./lb. body weight (maximum 3 gm.), which can be repeated after two weeks.(2) This regime has also been used in the treatment the subacute intestinal obstruction which can result from the " balling-up " of ascarids. The drug is non-toxic and cheap, especially as, being non-proprietary, it should be possible to manufacture it in bulk. It is at present the drug of choice for the field " deworming " of tropical children in, for example, schools. In fact, its only disadvantage appears to be that it is ineffective against both the hookworm and whipworm.

Tetrachlorethylene — a cheap, well-tried drug of low toxicity — is still the most effective form of therapy for ancylostomiasis. Moreover, recent work in poorly nourished patients in Central America has shown that a larger dose than previously recommended can both be tolerated and produces better results (0.05 cc./lb. body weight — maximum 5 cc.) ; while preparation and purgation are *not* required.(3) Tetrachlorethylene has the disadvantage of being almost ineffective against the roundworm, and may, indeed, stimulate this parasite to commence migration.

In proven or suspected cases of mixed infection with both the hookworm and the roundworm, it is probably best to treat initially with piperazine, followed two days later by tetrachlorethylene, or to employ hexylresorcinol, which is effective against both parasites. However, hexylresorcinol capsules are relatively expensive and, although not having any serious toxic effects, have to be swallowed intact, as, if chewed or broken open, the hexylresorcinol liberated can cause superficial chemical burns of the peri-oral skin. The drug cannot, therefore, be used for young or unco-operative children. The dose, which can be given without preparation or purgation, is 0.1 gm./year of *apparent* age up to the age of 10 years (maximum dose 1 gm.)

Although the perfect wide spectrum, non-toxic, cheap " universal " anthelminthic is still not available — and may never be so, and while work is being actively carried out in different parts of the world on such potentially valuable drugs as papain and dichlorophen, nevertheless the use of piperazine compounds, tetrachlorethylene and hexylresorcinol in the newer regimes suggested here has enormously simplified the treatment of ascariasis and ancylostomiasis in tropical children.

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(3) Carr, H. P., Sarda, M. E. P. and Nunez, N. A. (1954). *Amer. J. trop. Med., Hyg.*, 3, 495. Anthelminthic treatment of uncinariasis.

MALNUTRITION AMONG INFANTS AND YOUNG CHILDREN IN INDIA*

by

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Infants and young children constitute a vital segment of the population of a country. From the nutritional standpoint, they are a highly vulnerable group because of their special nutritional needs. The problem of malnutrition in infancy and early childhood, therefore, acquires special importance and deserves most careful consideration.

Mortality rates. All available data point generally to a highly unsatisfactory situation regarding the health of infants and young children in India. According to the latest census, infants and children under the age of 5 years, constitute about 13.3 to 13.6 per cent. of the population of India. However, deaths occurring within this age group account for 37.4 per cent. of the total deaths in the country (Table I). In certain parts of the country, the situation would appear to be even worse. For example, in Madras City, deaths of infants and children under the age of 5 years accounted for 48.7 per cent. of all deaths in 1954.

TABLE I. Deaths in different age groups in India.

Age in years	Registered deaths 1941-1950 per cent.	Population per cent.	
		1951	1954
Under 1	19.9	13.3	13.6
1-4	17.5		
5-9	6.2	12.8	13.6
10-14	3.9	11.3	11.1
15-19	3.9	10.1	9.4
20-25	8.0	9.0	8.8
25-29		8.1	8.5
30-35	7.9	7.2	7.6
35-39		6.3	6.4
40-49	7.5	9.8	9.8
50-59	7.8	6.4	6.3
Above 60	17.4	5.7	4.9

It has been calculated from the latest census that for the average Indian, the expectation of life at birth is about 32 years. It may be seen from Table II that this figure

TABLE II. Expectation of life at various ages for males.

Country	Period	0	5	10	15	25	45	65
Netherlands	1947-49	69.4	67.4	62.7	57.9	48.5	30.0	13.9
United Kingdom	1948	66.4	64.5	59.8	54.5	45.7	27.4	12.8
U.S.A.	1939-41	61.6	60.8	57.3	52.6	43.8	26.6	11.9
India	1941-50	32.5	40.9	39.0	36.2	29.8	17.6	8.2

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* Lecture delivered at the M.S. University, Baroda, in January, 1956.

used in the treatment the subacute intestinal obstruction which can result from the " balling-up " of ascarids. The drug is non-toxic and cheap, especially as, being non-proprietary, it should be possible to manufacture it in bulk. It is at present the drug of choice for the field " deworming " of tropical children in, for example, schools. In fact, its only disadvantage appears to be that it is ineffective against both the hookworm and whipworm.

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In proven or suspected cases of mixed infection with both the hookworm and the roundworm, it is probably best to treat initially with piperazine, followed two days later by tetrachlorethylene, or to employ hexylresorcinol, which is effective against both parasites. However, hexylresorcinol capsules are relatively expensive and, although not having any serious toxic effects, have to be swallowed intact, as, if chewed or broken open, the hexylresorcinol liberated can cause superficial chemical burns of the peri-oral skin. The drug cannot, therefore, be used for young or unco-operative children. The dose, which can be given without preparation or purgation, is 0.1 gm./year of *apparent* age up to the age of 10 years (maximum dose 1 gm.)

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Infants and young children constitute a vital segment of the population of a country. From the nutritional standpoint, they are a highly vulnerable group because of their special nutritional needs. The problem of malnutrition in infancy and early childhood, therefore, acquires special importance and deserves most careful consideration.

Mortality rates. All available data point generally to a highly unsatisfactory situation regarding the health of infants and young children in India. According to the latest census, infants and children under the age of 5 years, constitute about 13.3 to 13.6 per cent. of the population of India. However, deaths occurring within this age group account for 37.4 per cent. of the total deaths in the country (Table I). In certain parts of the country, the situation would appear to be even worse. For example, in Madras City, deaths of infants and children under the age of 5 years accounted for 48.7 per cent. of all deaths in 1954.

TABLE I. Deaths in different age groups in India.

Age in years	Registered deaths 1941-1950 per cent.	Population per cent.	
		1951	1954
Under 1	19.9	13.3	13.6
1-4	17.5		
5-9	6.2	12.8	13.6
10-14	3.9	11.3	11.1
15-19	3.9	10.1	9.4
20-25	8.0	9.0	8.8
25-29		8.1	8.5
30-35	7.9	7.2	7.6
35-39		6.3	6.4
40-49	7.5	9.8	9.8
50-59	7.8	6.4	6.3
Above 60	17.4	5.7	4.9

It has been calculated from the latest census that for the average Indian, the expectation of life at birth is about 32 years. It may be seen from Table II that this figure

TABLE II. Expectation of life at various ages for males.

Country	Period	0	5	10	15	25	45	65
Netherlands	1947-49	69.4	67.4	62.7	57.9	48.5	30.0	13.9
United Kingdom	1948	66.4	64.5	59.8	54.5	45.7	27.4	12.8
U.S.A.	1939-41	61.6	60.8	57.3	52.6	43.8	26.6	11.9
India	1941-50	32.5	40.9	39.0	36.2	29.8	17.6	8.2

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* Lecture delivered at the M.S. University, Baroda, in January, 1956.

compares very unfavourably with corresponding data from other countries. The fact that a very high rate of mortality among infants and pre-school children is responsible for this low figure is borne out by the observations that, unlike in countries like U.K. with a low infant mortality, the expectation of life in India increases from its value at birth as age increases (Table II). Indeed it is interesting to note that the expectation of life in India at the age of 20 actually exceeds that at birth.

An examination of the infant mortality statistics reveals some striking facts. The stillbirth rates and infant mortality rates reported from different parts of the country present an unsatisfactory picture. For example, the still-birth rate in the municipal areas of Madras State in 1949 was about 38 per 1,000 births (live and still). The infant mortality rate per 1,000 live births in Madras City in 1954 was 136, this incidentally being the lowest ever recorded. A comparison of the infant mortality rates in different countries (Table III) will serve to highlight the significance of these figures.

TABLE III. Infant mortality rates in different countries.

Countries	Rates in 1952	Countries	Rates in 1952
Sweden	20	U.S.A.	29
Netherlands	23	Ceylon	78
U.K.	27	India	116

The data presented so far indicate the serious magnitude of ill-health among Indian infants and children. It is, however, difficult to decide how far the high rates of mortality observed in Indian infants and pre-school children are attributable to malnutrition and how far they are the result of insanitary and unfavourable environment. Among poor communities, undernutrition and unhygienic environment are almost inseparable factors which tend to interplay with, and aggravate, each other. It may be unjustifiable, under the circumstances, to attempt to assess the relative contributions of these two factors to the end picture. However, a closer scrutiny of the data would seem to reveal some suggestive indications in this respect.

A considerable proportion of the infant deaths occur in the neonatal period. For example, nearly 25 per cent. of deaths of infants in Madras City in 1954 occurred within seven days after birth and nearly 38 per cent. within the first month (Table IV). When the figures for Madras State are examined, it is found that nearly 40 per cent. of infant deaths occur within the first month after birth. Neonatal mortality, therefore, contributes to the bulk of cases of infant mortality in India. An analysis of the causes of infant deaths reveals the important finding that 73 per cent. of deaths in infants below one month of age are directly attributable to " debility and premature birth " (Table V). It is reasonable

TABLE IV. Infant mortality in Madras among different age groups.

Age groups	Per cent. of total infant deaths
Under 7 days	24.9
7 days and under 1 month	13.4
1 month and under 6 months	32.1
6 months and under 1 year	29.6

to conclude, therefore, that a major factor responsible for the high infant mortality rate and the consequent low expectation of life at birth is the high incidence of prematurity and debility in the new-born infants. After the first month, there is an appreciable decline in the mortality rate which lasts till the end of the first year. Between the 1st and 5th years, however, mortality rates again tend to be high.

TABLE V. Principal recorded causes of infantile deaths in Madras City in 1954.

Cause	Number of deaths
Small-pox	40
Diphtheria	22
Enteric fever	3
Malaria	1
Other fevers	347
Dysentery	263
Diarrhoea	745
Infantile debility and premature birth	2,722
Respiratory diseases	2 328
Convulsions	413
Other causes	1,175
Total infantile deaths from all causes	8,059

Maternal malnutrition. The reason for the high incidence of prematurity in Indian infants requires examination. The work of EBBS and co-workers in Canada (1941), of the Committee of the Peoples League of Health of England (1946), of BURKE and STUART (1951) in U.S.A. and of SMITH (1947) in Holland have all pointed to a definite relationship between maternal diet on the one hand and the condition of the foetus at birth on the other. These studies have conclusively shown that an appreciable increase in the incidence of premature birth in a community is a characteristic of maternal malnutrition in that community. An analysis of 16,809 obstetric cases in the Women and Children Hospital, Madras (GOPALAN, 1949) showed that the incidence of premature births (using the criterion of birth weight of 5 lbs. or below) was 8.11 per cent. among the poor, general ward patients as against 1.65 per cent. among the well-to-do patients admitted to the special wards. Using the international criterion of birth weight of less than 5½ lbs. in full term infants as evidence of immaturity, VARKI *et al.* (1955) found that the incidence of immaturity in Coonoor was three times as high in a " poor group " as in a " well-to-do " group. From all this evidence, it may be justifiable to conclude that the high incidence of prematurity

TABLE VI. Nutritional status of 198 pregnant women in lower socio-economic group in Madras State.*

Apparently healthy women†	34 per cent.
Anaemia with oedema	9.5 "
Vitamin A deficiency	14.5 "
Angular stomatitis and glossitis	44.0 "
Burning feet	12.0 "
Tenderness of the calf muscles	18.5 "
Haemoglobin level —	
Over 12 g. per cent.	15.0 "
10-12 g. per cent.	29.0 "
less than 10 g. per cent.	56.0 "

* Several cases had more than one of the signs listed.
† Even among these there were several cases with mild anaemia.

and consequent neonatal mortality in poor Indian communities are attributable, to a considerable extent, to maternal malnutrition.

An idea of the extreme severity of malnutrition among pregnant mothers in the poorest sections of the population can be had from the results of a recent survey carried out under the auspices of the Nutrition Research Laboratories, Coonoor. In this survey the nutritional status of about 200 pregnant women belonging to the poorest sections of the population in South India was investigated. The results set out in Table VI reveal the serious magnitude of maternal malnutrition among the poorest sections of the population. It must be emphasised here that these figures pertain only to the lowest income groups of the population and cannot be considered to reflect the general nutritional status of the population. Even so they are important as providing one explanation for the high neonatal mortality rates mong the poor communities.

Lactation. If the infant manages to survive the hazards of the neonatal period, he enjoys relative safety till near the end of the first year, in spite of the fact that his insanitary environment continues unchanged. The explanation for this would appear to be that the infant receives during this period, through its mother's milk, the nutrients that it needs, in amounts which are probably not too inadequate. Indeed one of the most gratifying features with regard to the nutrition of infants belonging to the poor socio-economic groups is the fact that the lactation performance of their mothers, is evidently not unsatisfactory, at least for the first few months after delivery. Instances of inability to breast-feed the infant which are frequent among the sophisticated high socio-economic groups, are extremely rare among the poorest sections. This may be partly because of lack of psychological inhibitions to lactation among the poor mothers.

In a recent survey conducted by the staff of the Nutrition Research Laboratories, Coonoor, the 24-hour milk output of a series of 83 mothers in different stages of lactation was investigated, by carefully weighing the infants before and after each feed in 24 hours. It was found that the average 24-hour milk yield in this group varied from about 21 ounces within the first six months of lactation to about 12 ounces between the 18th and 24th months of lactation. The average daily protein intake of the mothers was about 50 g., the protein being almost completely derived from vegetable sources. Some of the mothers investigated in this study did not, however, belong to the poorest sections of the community, and for that reason, the results may not be considered to fully reflect the lactation performance of the poorest group*. The results, however, generally indicate that, in spite of the deficient diets of the mothers, their lactation performance was not unsatisfactory. It is interesting that even between the 18th and 24th months of lactation, there were instances wherein the milk yield was considerable. An investigation of the composition of breast milk obtained from poor mothers in different stages of lactation in Coonoor revealed that with regard to all the nutrients investigated, the milk of the poor mothers did not compare unfavourably with that of the mothers in better socio-economic groups (Table VII).

The above considerations should point to the need for encouraging breast-feeding of infants in poor communities. The question, however, has to be looked at from the point of view of the mother as well as of the infant. It has been shown here that poor mothers are able to secrete fair amounts of milk containing normal amounts of protein

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* A more recent longitudinal study carried out in a small group of mothers in Coonoor has revealed somewhat lower figures for 24-hour milk output.

TABLE VII. Composition of breast milk.

	g. per 100 cc. of milk			
	Protein	Lactose	Fat	Total solids
Poor Indian mothers	1.24	7.30	4.44	12.76
Healthy European mothers*	1.20	6.50	3.60	12.03

(* Mavis Gunther (1952) *Brit. J. Nutrition*, Vol. 62).

in spite of their deficient diets. This would not be possible without some degree of depletion of tissue proteins of the mothers. An examination of lactating mothers in poor communities does reveal gross evidences of malnutrition in them. To enable the mothers to maintain milk secretion at a desirably high level and even augment it, without deterioration of their health, it would be obviously necessary to provide them with adequate amounts of protein.

Birth weights of infants. From an analysis of the records of the Women and Children Hospital, Madras, it was found (GOPALAN, 1949) that the mean birth weights of a group of 1,269 babies born to mothers admitted to the paying wards of the hospital was 7.12 lbs. as against the mean birth weight of 6.3 lbs. of a group of 1,179 babies born to poor patients admitted to the general wards of the hospital during the same period. The above figures included only babies who weighed more than 5 lbs. at birth. If all the babies had been included, the differences between the two groups might have been even more marked. VARKI *et al.* (1955) determined the birth weights of a series of 500 (250 males and 250 females) infants born to women belonging to the poorest section of the population in Coonoor and compared these with the birth weights of a series of 200 infants (100 males and 100 females) born to women belonging to the well-to-do sections of the population. The average birth weight of infants in the poor group was 6.01 lbs. (males 6.05, females 5.96) while that of the infants in the well-to-do group was 6.85 lbs. (males 7.15, females 6.56). These findings again point to a definite relationship between the nutritional status of the mother and the condition of the infant at birth.

An infant normally tends to lose weight in the first few days after birth and it usually takes 7 to 10 days for the infant to regain its birth weight. The study of the changes in the body weight of the infant in the first few days after birth may provide some indication of the time taken for the establishment of adequate lactation in the mother (JELLIFFE, 1956). JELLIFFE investigated this point with regard to poor infants in rural West Bengal. He observed that, while only 25 per cent. of North American infants regained their birth weights by the seventh day and 50 per cent. by the tenth day, 70 per cent. of the poor infants in Bengal regained their birth weight in seven days and 90 per cent. in ten days. A study similar to the above was carried out at Coonoor (GOPALAN, 1956) on 46 infants belonging to the lowest socio-economic groups. It was observed that the mean duration for the maximum weight loss to be observed was 2 days, the mean weight loss being 3 ounces. The average duration taken for the infants to regain birth weight was 4 days. These data confirm JELLIFFE's experience and may be taken to reflect the ease with which full lactation is established in these mothers.

Growth. It would appear from available data that for the first few months after birth, the growth rates of poor Indian children are not far different from those of normal infants in the better technically developed regions of the world. However, while this is true of growth rates, the actual weights and lengths of poor Indian infants, even within the first six months after birth, are lower than those of normal infants of corresponding ages in the better technically developed regions of the world (Table VIII). In this respect, poor Indian infants would seem to differ from poor African infants, whose weights and lengths in the first few months after birth have been reported to actually exceed those of infants of corresponding ages belonging to the European countries (SÉNÉCAL, 1955). After the first few months, the growth rates of both the poor Indian as well as those of African children are decidedly poorer than those of normal European infants. The heights and weights of a series of poor infants and children in South India obtained in the course of an investigation conducted under the auspices of the Nutrition Research Laboratories, Coonoor, set out in Table VIII bear out the points made above.

TABLE VIII. Heights and weights of children under 5 years of age (S. India).*

Age	Mean weight in lbs.	Mean height in inches
1 month	6.32	20.4
2 months	8.8	21.1
3 months	8.4	21.0
4 months	9.8	22.1
5 months	11.8	23.2
6 months	13.05	23.8
7 months	13.50	24.7
8 months	12.50	24.0
9 months	13.2	24.6
10 months	15.4	25.9
11 months	14.8	26.0
1 year	14.8	26.9
Two years	18.0	29.1
Three years	22.1	32.4
Four years	26.5	35.6
Five years	30.2	38.5
Six years	32.0	39.9

* Total number examined = 1,014.

Supplementary feeding. The most difficult problem in practical nutrition in underdeveloped countries is presented by children between the ages of 6 months and 5 years. After the sixth month, breast milk becomes progressively inadequate and supplementary feeds providing adequate amounts of protein are called for. In poor Indian communities,

TABLE IX. Intake of nutrients by poor children under 5 years of age (S. India).

Nutrients	Mean daily intake in different age groups		
	0-2 years	2-3 years	3-5 years
Calories	634	717	856
Proteins (g.)	12.2	16.3	17.6
Calcium (mg.)	85	57	69
Iron (mg.)	4	6.1	6.8
Vitamin A or carotene (I.U.)	269	109	79
Thiamine (γ)	342	458	493

supplementary feeding of infants in one form or another is often started by the sixth month, but the supplements are mostly unmodified versions of the poor adults diet. The supplements are practically completely made up of cereal gruel with occasional helpings of vegetables. Milk, meat, eggs and pulses do not figure to any appreciable extent in these supplementary feeds. An example of the nutrient composition of the diets of children in the poor Indian communities is furnished in Table IX. which is based on analysis of the diets of 30 children under the age of 5 years belonging to the lowest socio-economic groups. It will be seen at once that the diets are poor in several respects. Actually, however, the net intake of nutrients is probably much lower than what these figures would indicate because of the complicating effects of infections and infestations which are widespread among these children.

Nutritional status of infants and young children. The results of a nutrition survey of nearly 1,000 poor infants and children under five years recently carried out in Madras

TABLE X. Results of nutrition surveys of 1,052 poor infants and young children in Madras State*

	Skin		Vitamin deficiency				Signs suggestive of protein malnutrition				
Age	Dryness	Folliculosis	A	B-complex	C	D	Dyspigmentation of hair	Sparseness of hair	Moon face	Marasmus	Enlarged liver
0-6 months (82 cases)	3	—	10	1	—	1	4	10	1	2	3
6-12 months (160 cases)	4	—	27	8	—	4	6	27	26	2	4
1-2 years (229 cases)	12	2	44	28	1	10	6	35	14	1	48
2-3 years (248 cases)	24	9	86	30	—	8	9	2	24	2	34
3-4 years (192 cases)	14	7	83	39	1	3	2	62	7	3	22
4-5 years (141 cases)	12	3	52	34	—	3	—	34	4	—	14

* The survey did not include children with advanced illness. This accounts for the absence of oedema and other signs.

TABLE XI. Haemoglobin levels in poor young children in different age groups (Madras State).

Age groups	Less than 4 g. per cent.	4-6 g. per cent.	6-8 g. per cent.	8-10 g. per cent.	10-12 g. per cent.	12-14 g. per cent.	14 g. per cent and above
0-6 months (23 cases)	—	4	6	9	4	—	—
6-12 months (95 cases)	4	6	19	39	23	4	—
1-2 years (141 cases)	—	13	26	59	31	12	—
2-3 years (145 cases)	—	8	21	53	39	24	—
3-4 years (137 cases)	—	12	23	37	48	15	2
4-5 years (101 cases)	1	7	11	27	39	15	1

State, under the auspices of the Nutrition Research Laboratories, Coonoor, are presented in Tables X and XI. These tables reveal some striking facts. The three most common signs of malnutrition among this group are those attributable to vitamin A deficiency, protein malnutrition and anaemia. Signs of vitamin C deficiency and rickets appear to be relatively rare.

Vitamin A deficiency. Nearly a third of the children surveyed showed definite clinical evidences of vitamin A deficiency — xerophthalmia or Bitot's spots. The incidence of vitamin A deficiency signs in children may not be quite so high in the northern and western parts of India. All available evidences, however, indicate that vitamin A deficiency constitutes a major nutritional problem among young children of Bengal and southern parts of India. The age incidence and distribution of vitamin A deficiency signs in a series of over 400 consecutive children examined in the clinic of the Nutrition Research Laboratories, Coonoor, and the Stanley Hospital, Madras, are indicated in Tables XII and XIII. The maximal incidence of vitamin A deficiency signs seems to fall upon young children below 5 years. The intake of vitamin A and carotene in the diet of these poor children is very low, the mean figure being 155 I.U. daily. There is reason to believe that a considerable portion of even this small intake may not be absorbed because of alimentary upsets, which are frequent among these children. Probably also the attacks of bronchopneumonia to which these children are often subject may tend to increase the vitamin A requirement.

TABLE XII. Age incidence of vitamin A deficiency (S. India).

Place	Below 1 year	1-2 years	2-3 years	3-4 years	4-5 years	5-10 years	10-15 years	15-20 years
Nutrition Research Laboratories, Coonoor	8	33	75	72	44	57	13	8
Stanley Hospital, Coonoor	64					39	16	10

TABLE XIII. Distribution of signs and associated features in 310 cases of vitamin A deficiency (S. India).

Nightblindness	51	Associated with kwashiorkor	56
Xerosis conjunctiva	69	Associated with B-complex deficiency	19
Bitot spots	147	Associated with phrynoderma	17
Keratomalacia	43	Associated with severe iron deficiency anaemia	4

Considering the surprisingly low levels of vitamin A intake, an even greater incidence of vitamin A deficiency than what is actually observed might have been expected. It is probable, however, that growth retardation consequent on protein deficiency may have a vitamin A sparing action. On the other hand, some of the worst instances of vitamin A deficiency were actually found in children suffering from florid manifestation of protein malnutrition.

The severity and acuteness of the ocular manifestations of vitamin A deficiency in these children vary greatly. Large numbers of cases are seen to exhibit xerosis of the conjunctiva or Bitot's spots which are relatively chronic and do not seem to progress rapidly within a few days. On the other hand, a few cases which are apparently normal in one visit have been seen to exhibit advanced keratomalacia after the lapse of a fortnight. According to some estimates, vitamin A deficiency is one of the commonest causes of preventable blindness in Bengal and Madras.

The problem of prevention of vitamin A deficiency in young children should not present as much difficulty from the economic point of view as that of protein malnutrition. The requirement of vitamin A in these poor children can be met by carotene, available from cheap vegetables and fruits. Carotene, though utilised to only roughly about 40 to 50 per cent. can be taken in amounts necessary to meet the vitamin A requirement. Unfortunately, however, even poor families who actually grow vegetables would rather sell vegetables in exchange for rice than consume them. Available evidence would suggest that the problem of vitamin A deficiency in children is more the result of avoidable ignorance and faulty feeding habits than of economic distress.

Protein malnutrition. The problem of protein malnutrition in young children has now attracted world-wide attention. The position with regard to this problem in India has been exhaustively reviewed (GOPALAN and RAMALINGASWAMI, 1955). The subject is, therefore, touched upon here only briefly. The diets of young children between 1 and 5 years, belonging to the poor sections of the population in India, are undoubtedly deficient in protein. The absolute daily intake of protein falls far short of the figures considered to be the adequate minimum and much of the protein is of poor quality. The absorption of even this unsatisfactory intake cannot be normal because of the frequent and almost invariable chronic alimentary upsets present in these children. Superadded infections probably also serve to raise the actual protein requirements. Other nutrients in the diet such as calcium, which are known to have a protein anabolic effect, and vitamins of the B-complex which help in the utilisation of proteins by the tissues, are also deficient in the diet. Under the circumstances, therefore, it is to be expected that the problem of protein malnutrition will figure greatly among the major causes of ill-health of poor children in this age period.

The full fledged picture of protein malnutrition in children has been described under the designation " Kwashiorkor," " Nutritional dystrophy," " Nutritional oedema syndrome," etc. It must be emphasised, however, that the problem of protein malnutrition in a community is much more extensive than what would be indicated by the incidence of kwashiorkor cases alone. Not all cases of protein malnutrition may be expected to present all the known clinical features of " kwashiorkor " — stunted growth, oedema, skin and hair changes, hypoprotinaemia, fatty liver, the characteristic faeces and mental changes. The incidence of some signs suggestive of protein malnutrition in a series of 1,000 poor infants and children in Madras is included in Table X. It cannot be claimed that these signs when present are diagnostic of protein malnutrition but taken in conjunction with the related dietary and other evidence, they may be considered to reflect the protein nutritional status in the community. With these limitations, the figures in Table X would indicate the magnitude of the problem of protein malnutrition among the poor children. The precise etiological significance of some of the signs listed in the table has still to be investigated. The occurrence of enlargement of livers in a high proportion of poor children, in particular, is a problem requiring further investigation as to origin and sequelae.

The problem of protein malnutrition in children resolves itself into the question of providing for poor children easily assimilable protein-rich foods which would be within their economic means. Since milk, which would be the ideal food for this purpose, is beyond the means of the poor, the question of finding cheap vegetable protein foods

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The problem of protein malnutrition in children resolves itself into the question of providing for poor children easily assimilable protein-rich foods which would be within their economic means. Since milk, which would be the ideal food for this purpose, is beyond the means of the poor, the question of finding cheap vegetable protein foods which could be used in the place of milk should engage our attention. At the same time, attempts to augment and expand milk production in the country should proceed apace.

Among the vegetable protein foods commonly used in the Indian dietaries, pulses require consideration, as being cheap and well known ingredients of Indian dietaries. The problem of processing vegetable protein foods and combining them in suitable proportions with a view to improving their nutritive value and making them easily assimilable by children occupies an important place in the practical nutrition activities of underdeveloped countries. Fortunately, recent researches into the amino acid composition of vegetable protein foods encourage the view that by suitable combination of the appropriate vegetable foods it should not be difficult to arrive at products approaching milk from the point of view of child nutrition.

Anaemia. It will be seen from Table XI that the incidence of anaemia in young children among poor Indian communities is considerable. There is obviously further scope for the investigation of the causal factors involved. Malaria and hookworm which are the major causes of iron deficiency anaemias in certain parts of India accounted for only a small number of cases of anaemia among the young children surveyed here. It is believed from the result of intensive investigation of a small group of poor children (MEHTA *and* GOPALAN, *1955) that the anaemias seen among the young children in poor Indian* communities are due to a combination of one or more of the following factors — a deficiency of iron, protein and liver principle.

CONCLUSION

The foregoing general survey will serve to indicate the extreme severity of malnutrition affecting the young children belonging to the poorest sections of the country. It may be expected that the sequelae of such severe malnutrition in childhood may well be carried into adult life. Malnutrition affecting the mothers and young children imperils the health and strength of the growing generation. Administrative action and scientific effort in the immediate future must be bent to meet this great challenge to the health of the nation.

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NEONATAL GASTRO-ENTERITIS DUE TO PATHOGENIC *ESCHERICHIA COLI* AND/OR *SALMONELLA WORTHINGTON*

by

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Epidemic gastro-enteritis in the neonatal period is rare, even in a country such as Indonesia, where diarrhoeal diseases form one of the commonest maladies of childhood. As long as the infant is breastfed and as long as there is no other additional feeding, the ways of infection are reduced to a minimum. An outbreak of infantile gastro-enteritis in a maternity ward — even when there is a lack of equipment and skilled personnel — draws the attention of the pediatrician to the possibility of an unusual etiology.

Pathogenic types of *Escherichia coli* have not yet been described in Java, so far as our knowledge goes, probably due to lack of laboratory facilities. Salmonellosis, however, has been described in Java by Kauffmann as early as in 1941 (Jelliffe et al, 1954). In general, the geographical distribution of organisms, whose identification is difficult, often seems to be in direct relation to laboratory facilities rather than to particular climatic or other special reasons.

Recent literature on pathogenic Escherichia coli *and* Salmonellosis.

Severe epidemics of infantile gastro-enteritis in nurseries or in infant wards due to pathogenic types of *E. coli* have been reported from all over the world. A special type of *E. coli* was first found by Adam in 1927 (Belnap and O'Donnell, 1955). This type was unique in its fermentation properties and occurred regularly in the faeces of infants with acute gastro-enteritis. Modern techniques in identification of coli strains were developed by Kauffmann and Dupont in 1947, according to their antigenic properties : the symbols O, K and H were used to represent the different somatic, capsular or flagellar moiety.

To date, 12 different serological types or subtypes of *Escherichia coli* have been incriminated as causes of epidemic infantile gastro-enteritis : O 111-B4, O 55-B5, O 26-B6, O 112a, 112b-B13, O 112a, 112c-B11, O 86-B7, O 119-B14, O 125-B15, O 126-B16 and O 127-B8. These types cannot be identified from ordinary cultures, and serological study is necessary. In the faeces pathogenic *E. coli* are mostly present in virtually pure cultures. The attack rate is high and adults may become temporary carriers.

In recent publications on pathogenic *E. coli*, strains have been demonstrated in Switzerland (Berger and Vest, 1955), Finland (Hallman et al, 1954), Japan (Fukawaza and Kinoshita, 1954), Israel (Singer), Germany (Hoster), Yugoslavia (Karakasevic et al, 1954), Hungary (Timar et al, 1954), the United States (Neter, 1955 ; Cooper et al, 1955 ; Belnap and O'Donnell, 1955) and Italy (Poli et al, 1954).

Of particular interest are reports where pathogenic types of *E. coli* and salmonellosis have been associated. Thus Taunay (1956) in Brazil reported an investigation of 55 infants with regard to pathogenic *E. coli*. In 13, *Escherichia coli* O 111-B4 could be demonstrated and in one *Salmonella butantan* as well. Of a control group of 10 breastfed and 10 bottlefed newborns, considered as normal, 4 showed slight diarrhoea and of these 3 had *E. coli* O 111-B4 in their stools and 2 had type 26-B6 in their nasopharyngeal secretions.

Fritsch (1955) in Germany has described an epidemic due to infection with *Salmonella newport* in 34 children. The first patient was 2 months of age and, of the other 33, only 3 were older than 2 years. The incubation period was 48 hours. Most patients were suffering from a second disease, which was the reason for their hospitalization (pertussis, pneumonia, poliomyelitis, tuberculosis).

The most extensive survey of the literature on salmonellosis in the tropics and subtropics is given by Jelliffe et al, 1954. According to this account, there are 150 species of salmonella. The severity of the disease is greater in the first months of life and septicaemic spread may develop during the neonatal period (meningitis, osteomyelitis). Infection occurs more easily in the poorly nourished, and the distribution of salmonellosis is worldwide, but the reports are apparently associated with the better bacteriological facilities. The clinical picture of salmonellosis may present as acute gastro-enteritis with high fever, loose stools — occasionally bloodstained — and with a high mortality rate in infants, whilst in older children recovery may set in after 2-4 days. The bloodborne infection of salmonellosis is similar to typhoid with

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1-3 weeks high remittent fever and with diarrhoea or constipation. The septicaemic picture of salmonellosis may be followed by various metastatic complications and has a poor prognosis — salmonella meningitis occurs almost exclusively in infants as a form of localized extra-intestinal infection. JELLIFFE et al, (1954) found the following salmonella types in their 40 cases : derby, typhimurium, oranienburg, cholera suis, newport, enteritidis var. jena, newington, anatum. The most frequently encountered was *S. typhimurium.*

REPORT OF OUTBREAK

In the second part of 1955, several newborn babies in a small maternity ward in central Java were found to be suffering from an apparently unusual type of gastro-enteritis with vomiting and anorexia. One of these patients was transferred to the Children's Department of Gadjah Mada University and an attempt at identification of the causative organism was undertaken.

History. The affected female neonate had been delivered at term and without complication, weighing 2,800 gm. Due to agalactia, skimmed powder milk was given from the second day onwards. On the third day the patient was found to be running a temperature of 40°C (104°F) and on the 4th day frequent small stools containing mucus were passed. The condition on admission, on the 5th day of life, showed the weight to be 2,600 gm. The temperature was 39.4°C (102.9°F), and the baby passed small, mucus-containing, slightly bloodstained stools during examination. The child appeared very weak. The heart and lungs were normal, the spleen was not palpable and the liver was palpable as expected in a child of this age. The skin was clean and there was no evidence of bleeding tendency, but dehydration was demonstrable.

Hypodermic infusion with " Hyalase " was given immediately and on the following 2 days. There was no response to sulphadiazine (200 mg./kg./day), nor to streptomycin orally (100 mg./kg./day), or to penicillin (300,000 units a day).

In addition, dietetic treatment, with protein milk, etc., produced no significant improvement in the condition. The weight remained steady and the stools did not improve, though the child became afebrile. On the 7th and 8th days, 30 c.c. plasma from the same blood group were given hypodermically with " Hyalase."

Microscopical stool examination revealed a virtually pure culture of enormous quantities of Gram-negative coli. Infection with pathogenic *E. coli* was suspected and the stool was cultured. The report from the laborary was : normal *E. coli* and a salmonella type of organism (without further identification). Due to lack of laboratory facilities,the two cultures were sent to the Bacteriological Institute of the University of Zürich, Switzerland (Director : Prof. Dr. H. MOOSER). Chlortetracycline (25 mg./kg./day) was given, replacing the previous treatment. There was a good response and the patient recovered quickly. A first relapse occurred in the 5th and a second relapse in the 10th week of life, both again responding to chlortetracycline. In both relapses, the same virtually pure cultures of *E. coli* were seen in the stools.

Identification of the organisms. The report from Prof. Dr. H. MOOSER reads as follows :

" *Culture I :* it is a coli strain which can be agglutinated by Coli-B4. Agglutination, however, does not take place when previously heated. Due to its unusual character further studies are necessary. *Culture II :* the strain has the characteristics of salmonella with regard to fermentation of sugar. However, it cannot be agglutinated by normal standard sera."

Both cultures were then forwarded to the World Health Organisation Salmonella Centre, Copenhagen (DR. KAUFFMANN, Statens Serum Institut), who reported : " *Culture I :* this coli belongs to O-group 126, differing, however, biochemically from E 6LL - J.

TAYLOR (test strain of O-group). *Culture II :* the organism is *Salmonella worthington* 1, 13, 23 : 1, w."

The case histories of infants in the above mentioned maternity ward were checked and it was found that 154 children were delivered from July until December, 1955. Out of these 117 (76 per cent. : group I) were fed on powdered milk only or on mixed feeding (mother's milk plus powdered milk) ; while 37 children (24 per cent. : group II) were breastfed only.

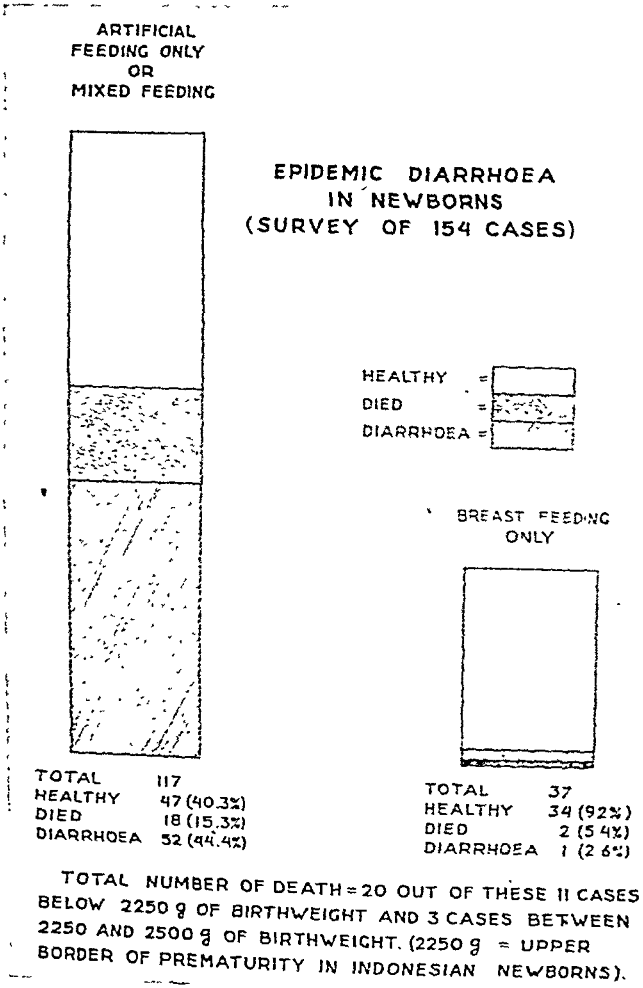

Fig. 1. Mortality and morbidity of epidemic diarrhoea in Indonesian newborn babies, with especial relation to method of feeding.

Of group I (Fig. 1), 70 children developed diarrhoea within the first days of life and of these 18 came *ad exitum*. Of group II, 3 developed diarrhoea and two of them died. Of the total mortality of 20 (group I and group II), 11 had a birthweight below 2,250 gm.* and three had a birthweight between 2,250 and 2,500 gm.

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* 2,250 gm. : upper border of prematurity for Indonesian neonates.

DISCUSSION

Pathogenic strains of *E. coli* seem to be ubiqitous. Their identification, however, is difficult, since serological procedures are necessary. The disease is highly contagious and contamination is apparently a faecal one from fresh cases or from healthy carriers. The disease occurs from the first days up to the first three months of life. Prematures show the lowest resistance, and artificial feeding paves the way for the spreading of infection.

There was no response to sulphonamides, streptomycin or penicillin. Chlortetracycline has proved successful in treating both the outbreak and relapses of the disease. If serological tests cannot be carried out, the age incidence, " virtually pure cultures " isolated bacteriologically from fresh stools, no response to sulphadrugs, but prompt results with chlortetracycline may suggest the correct diagnosis.

Salmonellosis also occurs in early infancy and has the same way of spreading as pathogenic *E. coli*. We feel unable to say whether the above described epidemic was due to pathogenic *E. coli* or to *Salmonella worthington* or to both of the organisms. There were no laboratory facilities to carry out serological tests for types of *E. coli*, nor tests for differential diagnosis of salmonellosis in potential spreaders or carriers. We are inclined, however, to the opinion that the pathogenic *E. coli* may have played the main rôle in the outbreak, since we have seen more infants suffering from gastro-enteritis and with the same picture of " virtually pure cultures " isolated bacteriologically. Both infections seemed to respond to chlortetracycline.

With regard to prevention, strict rules regarding sterilization and hygiene in infant care should be followed and supervised. Nurses, midwives and general practitioners should be instructed in feeding techniques and in the advantages and disadvantages of artificial feeding. The indication of partial or total artificial feeding should be clear and the decision should be left to the doctor and not to the nursing personnel.

SUMMARY

An outbreak of infantile gastro-enteritis in Indonesian newborn babies, due to a pathogenic strain of *E. coli* O 126 and/or to *Salmonella worthington*, is described. Spreading of the disease was favoured by artificial feeding. Contagiousness and mortality were high. The disease especially affected prematures. In the absence of serological laboratory facilities, diagnosis was based on the age incidence, direct microscopical finding of "virtually pure cultures," no response to sulphonamides or streptomycin, but a good response to chlortetracycline.

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PANCREATIC ACTIVITY IN NORMAL AND MALNOURISHED EGYPTIAN INFANTS

by

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In Egypt, malnourishment is quite common among infants of the poor class. Because of poverty and ignorance the mothers complement their deficient breast milk with rice water, starch or infusion of caraway, all being cheap predominantly carbohydrate foods. It is thus found that some infants are fed on pure starchy foods, some others on a mixture of starchy foods and a little milk and a third group on very little milk alone. The result of such faulty diets is that one meets various grades of wasting and various syndromes of malnourishment.

Such wasted and malnourished infants show a low tolerance to milk, which is manifested by frequent, pale motions containing undigested food matter which may suggest failure in the digestive capacity. Accordingly it was our aim to find out the state of pancreatic enzymes in various syndromes of malnourishment and compare this with the average normal findings in a similar age group. The study thus includes : (1) an assessment of pancreatic enzymes in normal infants : (2) an assessment of pancreatic enzymes in (a) kwashiorkor, (b) marasmus, (c) "growth failure syndrome" due to quantitative (caloric) underfeeding on an approximately balanced diet.

TECHNIQUE

A modified Levin tube specially designed for the purpose, 40 inches long, English size 6, radio-opaque and containing two holes in its last inch was used for duodenal intubation. This was introduced through the nose except in very young infants with narrow nostrils when it was introduced through the mouth. The tube was inserted blindly until it entered the stomach. Then it was guided under the x-ray screen until it reached the second part of the duodenum. Aspiration of duodenal juice was carried out by gentle and continuous suction, using a syringe. Fasting juice was collected and immediately examined for : (i) colour, (ii) pH, (iii) tryptic activity, (iv) diastatic index, (v) any abnormal constituent.

Trypsin Test. The method used was that of Fermi, as modified by Anderson and Early, using gelatine as the substrate. The latter was made by weighing 18.75 gm. of pure gelatine, adding about 40 c.c. of distilled water until the mixture became semisolid and then heating the solution in a boiling water-bath until it became clear. It was then cooled and the volume brought up to 200 c.c. with water. Little thymol was added and the solution was kept in a refrigerator, in which it can be stored for at least 6 weeks. Before using, the gelatine substrate was melted by being placed in the incubator at 37°C for an hour. The duodenal juice was diluted to 1 : 10 and 1 : 100 with 5 per cent. $NaHCO_3$ solution and then serial dilutions with 5 per cent. sodium bicarbonate were made as seen in Table I.

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TABLE I.

Tube No.	Volume of duodenal juice (c.c.) (1 : 100)	Volume of bicarbonate (c.c.)	Dilution	Tube No.	Volume of duodenal juice (c.c.) (1 : 10)	Volume of bicarbonate (c.c.)	Dilution
1	0.125	1.875	1 : 1600	5	0.2	1.8	1 : 100
2	0.25	1.75	1 : 800	6	0.4	1.6	1 : 10
3	0.5	1.5	1 : 400	7	0.8	1.2	1 : 25
4	1.0	1.0	1 : 200	8	1.68	0.32	1 : 6

A control tube was made by taking 2 c.c. of 5 per cent. sodium bicarbonate without any addition of the juice. To each tube, 2 c.c. gelatine substrate (previously heated at 37°C) was added and the tubes were incubated at 37°C for an hour, after which the tubes were placed in the refrigerator for 24 hours The first tube in which the gelatine is liquefied represents the maximum dilution at which digestion has occurred.

Amylase Test. The pancreatic amylase, on the other hand, was estimated by the method of WOHLGEMUTH, using 1 per cent. soluble starch containing 0.5 per cent NaCl. as the substrate. The juice was diluted in the same manner as previously, using buffer solution of pH. 6.6. To each tube 5 c.c. of starch substrate previously heated at 37°C was added. The tubes were then incubated for half an hour at 37°C, after which one drop of N/50 iodine solution was added to each tube. The colour obtained was observed, selecting *the tube with the lowest number that has a blue tinge mixed with the red. In the tube numbered* one below this there has been enough enzyme to completely convert 5 c.c. starch into erytherodextrin in half an hour. The amount of 1 per cent. starch that is converted to erytherodextrin by 1 c.c. enzyme in 30 minutes is the diastatic power or index

RESULTS

(1) *Normal infants.* 19 normal infants were intubated. Their ages varied from 1 month to 2 years. (Table II). The juice collected was found to be either colourless, yellow, orange or green. The pH was 7-8 in 16 cases, and 6.5 in 3 cases. The diastatic index varied between 250 and 500 in the group consisting of children aged between 1-3 months ; while in children in the 4-12 months age-group, it was between 500 to 1,000. In the second year it was in the range of 1,000-2,000. As regards tryptic activity, it was found that from the first month to the end of the first year gelatine was digested at a dilution of 1 : 100. From the end of the first year to the end of second year digestion occurred at a dilution of 1 : 200 to 1 : 100.

(2) *Infants with kwashiorkor.* Nine cases of kwashiorkor were submitted to duodenal intubation. (Table III). Their ages varied from 4 months to 2 years 9 months. The dietetic history in all cases revealed the prolonged administration of a mainly starchy diet with very little milk or none at all.

In this series, the earliest change observed, apart from wasting, was in the scalp hair which became rough and easily shed off but with an approximately normal colour. Next in order, the cheeks became pale, bulky and waxy in appearance. At the same time, the thighs appeared as if " water-logged," but without frank oedema. The stools in the early cases of kwashiorkor were frequent, pale and foetid, but not loose. Manifest oedema and/or dermatosis would appear after an attack of diarrhoea or entero-colitis. Dermatosis was not found to be a sequela of the oedema. In one case it was well marked in spite of the absence of oedema. In another case, dermatosis was very severe affecting the napkin area, buttocks and suprapubic region up to the umbilicus, while the oedema was only manifested as puffiness of the eyelids. Liver enlargement, which was constantly present in the fully developed cases, was not found in the early cases presenting hair changes or " water-logging " in cheeks and thighs.

Duodenal juice in well-developed cases of kwashiorkor was scanty in amount, usually colourless and full of mucin. Tryptic activity was always absent in a dilution of 1 : 25 and even of 1 : 6. The diastatic index, on the other hand, varied between 250 and 1,000 being diminished in some cases and normal in others.

TABLE II. Duodenal juice in normal infants.

Case No.	Age (months)	Sex	Diet	Weight (Kgm.)	Duodenal juice			
					Colour	pH.	D.I.*	Trypsin.
1	1	M	B.F.	3.7	White	8	500	1 : 100
2	1	M	B.F.	3.9	Green	8	250	1 : 100
3	1	F	B.F.	3.7	Green	8	250	1 : 100
4	1	M	B.F.	3.9	Yellow	7	500	1 : 100
5	1	M	B.F.	3.8	Yellow	8	500	1 : 100
6	2	F	B.F.	4.1	Yellow	8	500	1 : 100
7	2½	F	B.F.	4.3	Yellow	8	500	1 : 100
8	3½	M	B.F.	5.0	Yellow	8	500	1 : 100
9	6	M	B.F.	5.7	Yellow	6	500	1 : 100
10	6	M	B.F.	7.0	Orange	8	500	1 : 100
11	7	F	B.F.	6.5	Yellow	8	500	1 : 100
12	10	M	B.F. + rice	7.5	Yellow	7	500	1 : 100
13	11	M	B.F. + rice	8.0	Green	7	500	1 : 200
14	11	F	B.F. + starch	8.3	Pale Yellow	8	1000	1 : 200
15	12	M	B.F. + mixed diet	8.5	Yellow	8	1000	1 : 200
16	16	F	B.F. + mixed diet	8.5	Green	7	500	1 : 200
17	20	F	weaned	9.5	Colourless	7	2000	1 : 100
18	24	F	weaned	10.0	Green	6	1000	1 : 100
19	24	M	weaned	11.5	Greenish Yellow	8	200	1 : 200

* D.I. - Diastatic index.

TABLE III. Duodenal juice in kwashiorkor cases.

Case No.	Age (months)	Sex	Dietic History	Weight (Kgms.)	Hair Changes	Oedema	Dermatosis	Liver Enlargement	Duodenal juice	
									D.I.*	Trypsin
1	4	M	B.F. for 14 days "Quaker Oats" + starch. No milk.	5.3	+	—	—	—	500	1 : 50
2	8	M	Dr'd milk 6 M Rice with no milk last 2 M	5.4	+	—	—	—	1000	1 : 50
3	7		Rice and starch since birth. No milk.	4 0	+	—	—	—	1000	Absent (1 : 6)
4	12	F	B.F. for 6 M Rice with no milk for 6 M	4 8	++	—	++	++	250	Absent (1 : 25)
5	12	F	B.F. (little) + starch for 8 M. Starch with no milk for 4 M	6 3	++	++	—	++	1000	Absent (1 : 25)
6	33	M	B.F. for 1 5 yr. Starch + potatoes + beans. No milk	10 1	++	+++	+++	++	1000	Absent (1 : 25)
7	13	F	B.F. (little) 9 M. Quaker and Starch from the 4th M	8 0	++	+++	+++	+++	250	Absent (1 : 25)
8	12	F	B.F. for 4 M Rice for 8 M	5 8	++	+++	++	++	1000	Absent (1 : 6)
9	9	F	Milk for 1 5 M Rice with no milk for 7.5 M	4 0	++	+	++++	+++	1000	Absent (1 : 6)

* D.I. = Diastatic index.

Two cases presenting the earliest manifestation, i.e. changes in the hair, had tryptic activity in a dilution of 1 : 50 — that is to say the trypsin had started to diminish, but had not yet disappeared. The diastatic index, on the other hand, was still within the normal range of 500-1,000.

In the advanced cases with the appearance of "water-logging" of the cheeks and/or thighs, enlargement of the liver and/or dermatosis, no tryptic activity was detected in

1 : 6 dilution. The diastatic index varied from 250 to 1,000, that is diminished in some, normal in others.

Accordingly it can be concluded that :

(i) In well-established cases of kwashiorkor, the duodenal juice is scanty, full of mucin, with no tryptic activity at a dilution of 1 : 6, and with a normal or diminished diastatic index.

(ii) Tryptic activity starts to diminish very early in kwashiorkor and its complete absence precedes liver enlargement, oedema and dermatosis.

Similar findings were reported by CARVALHO, SCHMIDT and PINTO (1947), who intubated 6 children during convalescence from kwashiorkor, and noted that the amount of trypsin and lipase in the duodenal juice was reduced. VEGHELYI (1948) also found that pancreatic enzymes were affected. Lipase was reduced first, and afterwards trypsin ; amylase survived considerably better and never disappeared completely. More recently VEGHELYI (1950) found that a diminution of the pancreatic secretion preceded the enlargement of the liver or any change in hepatic function. THOMPSON and TROWELL (1952), investigating cases of kwashiorkor in Kampala, Uganda, came to the same conclusions and on examining the pancreas at autopsy, it was found to be atrophied. The atrophy of the pancreas in kwashiorkor is generally attributed to prolonged protein deficiency, as it was found experimentally that a low protein diet fed to rats produced atrophy of the pancreatic cells (FRIEDMAN and FRIEDMAN, 1946), and a low protein, high carbohydrate diet, comparable to diets on which children develop kwashiorkor, has a similar effect (KRISTAL, 1947).

(3) *Marasmus.* Four infants, aged between 24 days and 7 months, presenting the clinical picture of marasmus were submitted to duodenal intubation. (Table IV). The dietetic history revealed prolonged periods of preceding under-feeding. The duodenal juice was scanty. Tryptic activity was absent in 1 : 6 dilution in three cases and was diminished (1 : 50) in the fourth. Amylase, on the other hand, was within the normal range.

This is, therefore, suggestive that in marasmus, tryptic activity disappears early

TABLE IV. Duodenal juice in marasmus cases.

Case No.	Age (months)	Sex	Dietetic History	Weight (Kgm.)	Duodenal juice			
					Colour	pH.	D.I.*	Trypsin
1	3	M	B.F. ——> 1 M Rice water —> 2 M	3.3	Colourless	7	500	Absent (1 : 25)
2	3	F	B.F. (v. little) + caraway infusion	3.3	Yellow	7	250	Absent (1 : 6)
3	24 days	M	Weaned since birth caraway infusion	2.2	Green	7	250	Absent (1 : 6)
4	7	F	B.F. ——> 2 M Rice water ÷ little milk ——> 5 M	3.5	Colourless	7	1000	1 : 50

* D.I. — Diastatic index.

whereas amylase usually persists. Absence of trypsin can be explained, as in kwashiorkor on the basis of prolonged protein deficiency.

(4) " *Growth failure syndrome.*" Not uncommonly we see cases whose weight and height are far below the average although their body constitution appears to be approximately normal. Fat is present in the abdominal wall as well as in thighs and buttocks in a fair amount — thus a child of two years may look like a healthy normal infant of 8 months. It appears that almost no growth is taking place and that the approximately balanced diet, which is deficient only in calories, is just maintaining life. These infants are retarded in weight, height and development, although dentition is usually not delayed. Duodenal juice in three cases of this type (Table IV) showed a quite normal diastatic index as well as tryptic activity.

TABLE V. Duodenal juice in cases with " growth failure syndrome."

Case No.	Age (months)	Sex	Dietetic History	Weight (Kgms.)	Length (cms.)	Duodenal juice	
						D.I.*	Trypsin.
1	28	F	B.F. ————> 1½ years starch + little milk	8.0	68	2000	1 : 100
2	8	F	B.F. ————> 1 month starch + little milk	3.6	57	500	1 : 100
3	17	F	B.F. (little) —> 2 years starch + little milk	5.4	66	1000	1 : 100

* D.I. — Diastatic index.

SUMMARY

Pancreatic activity was studied in 19 normal infants, in 9 cases of kwashiorkor, 4 marasmic and 3 cases showing the " growth failure syndrome." All cases of marked kwashiorkor showed scanty duodenal juice with excess mucin, absent tryptic activity and diminished or normal amylase. Trypsin started to diminish very early before the development of liver enlargement, oedema or dermatosis. Marasmic infants showed scanty duodenal juice and absence of tryptic activity, although the amylase was normal. Absence of trypsin in both kwashiorkor and marasmus may be attributed to prolonged protein deficiency. Infants with the " growth failure syndrome," due to caloric underfeeding on an approximately qualitatively balanced diet, showed normal pancreatic activity.

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THE SERUM LIPIDS IN KWASHIORKOR

I. NEUTRAL FAT, PHOSPHOLIPIDS AND CHOLESTEROL

by

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and

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It is well known that post-mortem examination of the liver of a child who has died of kwashiorkor usually reveals an intense fatty infiltration, most marked in the periphery of the liver lobules. If, however, a high-protein diet has been given for only a few days before death, little fat may be visible, and that only in the periphery of the lobules from which retreat is slowest (DAVIES, 1951). The full degree of the infiltration is best demonstrated by chemical analysis, which may show that in the acute stage of the disease nearly half the wet weight of the tissue is accounted for by fat (WATERLOW, 1948 : AUFFRET and TANGUY, 1950).

Very little has been done to define the composition of the lipids. When the livers of two children who had died of kwashiorkor at Mulago were analysed by Professor A. C. FRAZER at Birmingham, he reported large increases in free fatty acids and glycerides, and a moderate increase in cholesterol, in comparison with the amounts found in healthy European children, but values for phospholipids that were within the normal range (TROWELL, DAVIES and DEAN, 1954). The increase in cholesterol was also found in biopsy specimens of liver taken at Coonoor (SRIRAMACHIRI and RAMALINGASWAMI, 1953). It is possible, by analogy with work on experimental animals whose livers were made fatty by a low-protein, high-fat diet, and by carbon tetrachloride (GAJDOS, 1951) that most of the cholesterol in the livers was in the esterified form. The relevance of this work to kwashiorkor is, however, uncertain.

There have been few studies of the lipid constituents of the serum in kwashiorkor. Estimations of the total lipids made by VAN DER SAR (1951) in Curaçao showed a wide range in 16 children on admission to hospital : in 6 children the values were between 360 and 635 mg./100 ml., in 5 between 667 and 855 mg./100 ml., and in 5 between 930 and 1,490 mg./100 ml. The estimations were repeated on 10 children at the time of discharge : 4 showed a rise and 6 a fall. CARVALHO (1947) gave an average value for serum phosphate in Brazilian children that corresponds to about 140 mg. phospholipid/100 ml.

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The total serum cholesterol was found usually to be considerably below the normal level by CARVALHO (*op. cit.*), by DELON (1951) in Morocco, by ourselves at Kampala (DEAN and SCHWARTZ, 1953), by workers of the Nutrition Research Laboratories in Coonoor, South India (Annual Report, 1954), and by DEMAEYER and VANDERBORGHT (1954) in Kivu Province, in the Eastern part of the Belgian Congo. VAN DER SAR (*op. cit.*) quoted the results of 16 estimations, of which 10 were below 150 mg./100 ml., and should therefore probably be considered abnormal. He found in most of his cases ratios of free to total cholesterol over 0.30 ; abnormally high average ratios of 0.60, 0.76 and 0.49 were found in Coonoor, in Kampala and in the Belgian Congo respectively. In all three places, treatment caused a large increase in the total cholesterol by the end of two or three weeks, due principally to an increase in the esterified fraction, so that the ratio of free to total cholesterol fell.

Another observation of interest in connection with lipid metabolism was made at Kampala, but has remained unpublished. When a series of estimations of organic and inorganic phosphate was being made, it was noticed that the acid-insoluble phosphate was small in amount when the child was first admitted to hospital but that during treatment it increased and then decreased — fluctuations similar to those of total cholesterol, which also usually reached a peak value and then declined. Since acid-soluble phosphate is largely lipid phosphate, the observations gave another reason for believing that a study of the lipid fractions in the serum might be profitable.

THE CHILDREN AND THEIR TREATMENT

The children who were investigated had all been admitted to the wards of the Infantile Malnutrition Group for the treatment of kwashiorkor. All could be considered typical cases, according to the criteria of diagnosis used at Mulago (TROWELL, DAVIES and DEAN, 1954) but inevitably they differed in the degree of severity of their general condition, their growth failure, their alterations of hair and skin, and their oedema. All except 3 had total serum proteins of less than 5.0 g./100 ml., and all except 3 had less than 2.0 g. albumen/100 ml. In 4 of the children the serum amylase was between 30 and 70 units/100 ml., and in the others it was less than 25 units/100 ml.

The children numbered 20, and were all between 15 and 30 months old. The foundation of the diet used for treatment was milk protein, derived from either a mixture of dried skimmed milk and a preparation of calcium caseinate (" Casilan," made by Glaxo), or the dried skimmed milk alone. About 50 g. protein was usually offered daily from the first day but the anorexia that is so common in the early stage of treatment nearly always restricted the actual intake in the first week : no child, however, had less than 20 g. daily in that period. Sweetening, and extra calories, were provided by sucrose, but to avoid the diarrhoea caused by the intolerance of sugar (DEAN, 1952) the total amount of sugar, including the lactose of the milk, was usually restricted to about 50 g. daily for the first two weeks or more.

It has recently been found in Kampala (DEAN and WEINBREN, to be published) that most children, even in the acute stage of kwashiorkor, can safely be given each day up to 50 g. of a locally produced refined cottonseed oil. It causes no digestive upset, and is valuable as a source of calories. Six of the children whose serum lipids were investigated had the oil at some time during their treatment. The diets of the other children were free of fat except for the very small amount, found by analysis to be about 0.8 g./100 ml., in the dried skimmed milk.

METHODS

It is usual to bleed each child on the day of admission to hospital, but some of the children were for various reasons not bled until they had been treated for a day or two. The bleedings were repeated every 7 days, but some children were bled twice in the first week. The blood was taken from the internal jugular vein, between nine and ten in the morning : as the first feed of the day was at six, the blood constituents that vary with the immediate food intake were presumably at fasting levels. The blood was allowed to clot at room temperature, ringed, and centrifuged for 20 minutes at 2,000 r.p.m. The serum was pipetted off and kept frozen at −4°.

The serum lipids were extracted from 0.3 ml. serum by Bloor's procedure, the final total volume being 10 ml. The extract was filtered and 5 ml. was evaporated to dryness in a pyrex test tube. The residue was digested with 1 ml. 60 per cent. perchloric acid and phosphate was determined by the method of Allen (1940). The value for phospholipid was obtained by multiplying the amount of phosphorus/100 ml. serum by the factor 22.7 (Kosterlitz, 1947). Another 2 ml. of the extract was taken for the estimation of the total lipids by the turbidimetric method of De la Huerga, Yesinick and Popper (1953).

The method of Schoenheimer and Sperry, as modified by Sobel and Meyer, was used for the estimations of free and total cholesterol previously reported from Kampala (Dean and Schwartz, 1953). In this method, colour development has been found to be somewhat variable, and there have been indications from time to time that extraction at room temperature from the sera of children with kwashiorkor has not been complete. For the present series, the method employed was that of Zak, Dickenman, Waite, Burnett and Cherney (1954), in which the alcohol-acetone extraction mixture is used boiling. A final volume of 10 ml. of the mixture contained 0.3 ml. serum. After filtering, 2 ml. of the extract was taken for the estimation of the total cholesterol and was evaporated to dryness ; for the estimation of the free cholesterol another 5 ml. of the extract was treated with 1 ml. 1 per cent. digitonin, the precipitate was separated by centrifuging, washed once with acetone and dried in a boiling water bath. Both residues were dissolved in 3.0 ml. glacial acetic acid and the colour was developed by the addition of 2 ml. 25 per cent. ferric chloride in glacial acetic acid, diluted freshly 1 : 100 with concentrated sulphuric acid. The colour was stable for at least one hour and the method gave consistent results from day to day. The figure for esterified cholesterol was obtained by difference, but the weight of the cholesterol ester was calculated by multiplying by the factor 1.69, in accordance with the usual convention.

Samples of the same sera were analysed by both of the methods. The modified method of Schoenheimer and Sperry gave results that were nearly always 20 to 30 per cent. lower than those obtained by the method of Zak et al.

The amount of neutral fat was calculated by subtracting the combined amount of phospholipid, free cholesterol and cholesterol ester from the amount of the total lipids.

RESULTS

Fig. 1 shows the average values for total lipids found at different times during treatment. Sixteen children were bled on the day on which they were admitted to hospital

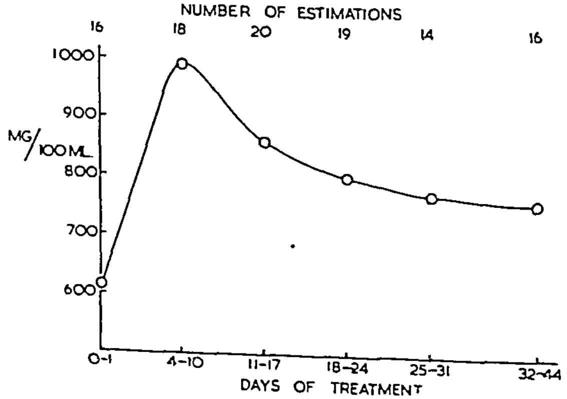

FIG. 1. Alterations in total lipids in the serum of children under treatment for kwashiorkor.

or the day after, and the average for their total lipids was 604 mg./100 ml. serum. Three children from whom blood samples were taken on the next day had values of 1,395, 1,280 and 565 mg./100 ml. serum that have not been included : the 18 children bled during the period from the 4th to the 10th day had an average value of 979 mg./100 ml. and in the subsequent periods the average values fell.

Although the curve shows clearly the remarkable rise near the beginning of treatment, it obscures some important changes because it represents the summation of many curves, similar in general shape, but different in height and amplitude. A typical set of results for one child is shown in Fig. 2. In this child the final value for total lipids was higher than previous values, and a similar rise was found in 14 children, although that cannot be seen in Fig. 1.

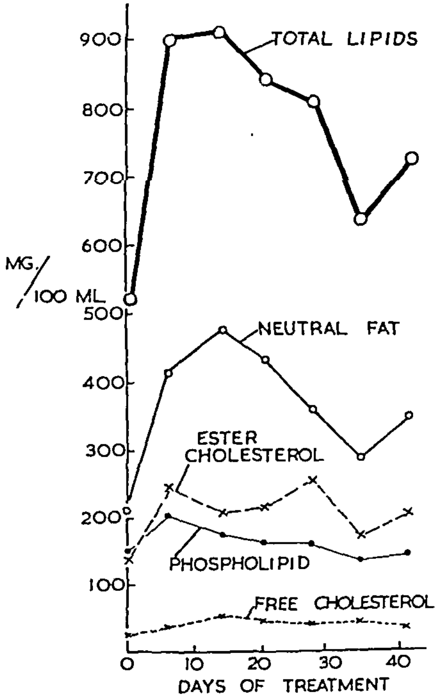

FIG. 2. Alterations in total lipids, and in lipid fractions, found in one child during treatment. Neutral fat made the greater contribution to the rise that occurred soon after treatment had begun. The amount of esterified cholesterol also increased considerably.

Because the children differed in the degree of severity of their illness and because their response to treatment was variable, as it must always be, the peak values and the subsequent troughs were found at different times. It seemed logical therefore to express the detailed results not strictly by day of treatment, but by reference to the high and low values for the total lipids. The results obtained in this way are given in Table I. The peak values were always found in the first ten days, and the lowest usually between the 25th and 35th days. Exceptions were the 6 children whose values were still falling slightly

TABLE I. Average values (in mg./100 ml. serum) for total lipids, phospholipids, neutral fat and cholesterol in (a) 14 children bled on the day of admission, or the day after and regularly throughout treatment, (b) 14 children whose total lipids showed a rise at the end of treatment.

	Total Lipids	Phospho-lipids	Neutral fat	Cholesterol*			Free chol.: Total chol.	Total chol.: phospho-lipids	Total chol.: Total lipids	Phospho-lipids: Total lipids
				Free	Ester†	Total				
(a) 14 *children bled regularly*										
1. On admission	532 (Range 366-653)	145	241	49	91	105	0.47	0.72	0.20	0.27
2. At highest value for total lipids	969 (Range 791-1,485)	206	486	63	220	190	0.33	0.90	0.19*	0.21
3. At lowest value after 2	644 (Range 468-815)	151	272	40	180	147	0.28	0.97	0.23	0.23*
(b) 14 *children with rising total lipids at end of treatment*										
1. At trough value	651 (Range 468-815)	154	278	42	179	147	0.29	0.97	0.23	0.23
2. At final value	827 (Range 686-1,030)	180	380	47	217	176	0.27	0.97*	0.21	0.21
Normal children, 5-60 months old (ERICKSON et al., 1932)	674	200	192	65	194	217	0.30	1.08	0.32	0.30

† Total *minus* free cholesterol *multiplied by* 1.69 (see text).
* Not significantly different, by statistical analysis, from the average value immediately above In all other cases, the values differ significantly

at the end of treatment on the 26th to 38th day : presumably, if those children had been kept longer in hospital, they too would finally have shown rising values. Table I gives the results obtained for 14 children who were bled on the day of admission, or the day after, and regularly afterwards. The results for the 14 children who showed the final rise are analysed separately.

The lipid and cholesterol fractions. The amounts of phospholipid and neutral fat, and of total and esterified cholesterol, all showed a tendency to rise and fall together, but there were some notable variations that are perhaps best expressed by percentages of the initial values. Neutral fat and ester cholesterol rose by 100 and 140 per cent., and phospholipid and free cholesterol by about 40 and 30 per cent. ; afterwards, when the total lipids were falling, the ester cholesterol was maintained near its high level, but the other fractions decreased to near their starting levels. In the final rise all the components increased by about 20 per cent. from their low levels, except the neutral fat, which increased by 40 per cent ; that extra amount was, however, probably without special significance.

Ratios. The ratios between some of the fractions are shown in Table I. They did not fluctuate in the same way as the average values for the fractions. The ratio of total cholesterol to total lipid remained nearly stationary, that of total cholesterol to phospholipid rose considerably, and that of phospholipid to total lipid fell. The ratio of free to total cholesterol showed the fall that had been noticed previously (DEAN and SCHWARTZ, 1953).

The effects of different diets. There were no discernible differences in the responses of the children to treatment that could be related to differences in the diet used. Even those children whose intake was sharply limited by anorexia in the first days of treatment showed the rapid rise of total lipids, and the presence or absence of dietary fat seemed to have no influence on any of the values.

DISCUSSION

It has not been possible to trace any large series of comparable data for healthy children in Europe or the United States, but figures for children of all ages from 5 months to 9 years, given by ERICKSON, WILLIAMS, HOMMEL and MACY (1937) have been included in Table I. From these figures, it seems that, in the children acutely ill with kwashiorkor, the most remarkable deviations from normal were the high value for neutral fat and the low value for ester cholesterol. The average of the values for the 3 children aged 5, 24 and 25 months investigated by ERICKSON et al. was, however, 218 mg./100 ml., and the figure of 241 mg./100 ml. for the ill children may not be very abnormal. The children could not be kept in hospital until their lipid levels were completely stabilised, and the levels at the time of discharge may therefore be misleading ; it has, however, been found that other children, who have returned for follow-up, examination several months after discharge, usually have levels similar to those found in the present series when the rise occurred at the end of treatment. They appear to show one difference that may be of importance : the amount of total cholesterol is somewhat lower. Long-term studies are in progress, and will be reported as soon as the results have statistical validity.

The most notable changes observed during treatment were undoubtedly the sudden increases of neutral fat and of esterified cholesterol. The fact that the changes occurred whatever the amount or kind of diet suggests that although they were brought about by the diet, they were probably largely endogenous. The excess amounts of neutral fat and esterified cholesterol that appeared in the serum were almost certainly not of dietary origin. The fat was found whether or not the diets contained the cottonseed oil, and none of the diets could have contained significant amounts of pre-formed cholesterol. It is conceivable that some fat was synthesised from carbohydrate, or even from protein, and that some cholesterol was derived from acetate and other sources, but the rapidity and extent of the increases make such explanations unlikely : an explanation that is more acceptable is that the fat and cholesterol were already formed and were mobilised when treatment began. Most of the fat in the serum was probably in the form of non-esterified fatty acids : the serum was never cloudy unless the fatty diet was being given.

When the increase of esterified cholesterol during treatment was first reported, it was considered that it was probably brought about by the resumption of activity of the enzyme cholesterol-esterase, occurring in the same way as that of other enzymes ; for example, pancreatic amylase. The theory was advanced that the acquisition of protein or of amino acids enabled protein synthesis, which must include enzyme synthesis, to be re-started. The present results do not make necessary the complete abandonment of that theory, but suggest a supplementary theory : that one of the early effects of correct and successful treatment may be the release of fat and cholesterol from stores in the tissues. The tissue that is most probably the chief repository is the liver, and the theory is consistent with known data about the composition of the liver in acute kwashiorkor. For various reasons, we have been unable to undertake liver biopsies, and the decision to publish our results in their obviously incomplete present form was made because it was hoped to stimulate other workers, who can do the biopsies, to refute or confirm our findings. If it is proved that the increase of neutral fat and cholesterol in the serum is due to these substances being unlocked from the liver, and possibly from other depots as well, it would be justifiable to argue that the inability to mobilise fat, and not merely its presence in large amounts in the liver, might be one of the cardinal signs of kwashiorkor. There will be much to explain : some recent work has shown that the characteristic deposition of fat in the liver, in the periphery of the lobules, can be caused in experimental animals by giving diets that are very poor in protein, and that supplementation of the diets with choline will not prevent the deposition (BEST, HARTROFT, LUCAS and RIDOUT, 1955) : there is general agreement that the giving of protein in a bland form to a child suffering from kwashiorkor will often assist his recovery, and the successful use of the proteins of both milk and soya (DEAN, 1952 ; THOMPSON, 1955), of Bengal gram, *Cicer arietinum* (Annual Report, 1954), and of a synthetic amino acid mixture and vitamin-free casein (BROCK, HANSEN, HOWE, PRETORIUS, DAVEL and HENDRICKSE, 1955) supports the idea that the kind of protein used in treatment is of little importance : but very little is known about the enzymatic or other processes that are responsible for the mobilisation of fat, in health or in disease.

It is one of the remarkable features of many autopsies on children who have died of kwashiorkor that not only is the liver very fatty but there are large quantities of subcutaneous fat, widely distributed. It is by no means unusual to find a layer of fat 1 to 2 cm. thick in such sites as the anterior abdominal wall and the inner aspects of the thighs : the presence of the fat, which has also been demonstrated in the soft tissues around the wrist and knee in the course of the X-ray examinations of those joints (JONES and DEAN, to be published) is incidentally one of the features that distinguish kwashiorkor from marasmus. In kwashiorkor, the child must often starve to death in the presence of one kind of plenty ; he is probably in desperate need of calories, as well as of protein, if his appetite has long been failing, and yet he cannot make use of his fat. He may be rescued if he is given protein and can make proper use of it, and it seems that some of the fat enters the blood stream. If it can be metabolized, it will provide him with some of the calories he needs for protein synthesis, and may obviate, at least in part, the need for a high-calorie diet in the early stages of treatment. It is difficult to explain in any other way how the first steps in recovery may occur on a high-protein diet despite an extremely low intake of calories. In the wards of the Infantile Malnutrition Group, a complete record of dietary intake is kept in every case, and it will be of interest to determine whether or not the introduction of the high-calorie diets that can be given from the first day after admission, to which reference has already been made, accelerates improvement in the clinical and biochemical condition.

The fall in the amount of neutral fat that succeeded the rise presumably represented utilisation in a normal manner, a process that might be studied by serial biopsies of subcutaneous fat, and in other ways. It is a matter of simple clinical observation, confirmed at Mulago by measurement with skin-fold callipers, that many children convalescing from kwashiorkor greatly increase their subcutaneous fat. Some children, however, fail to gain weight satisfactorily, and it may be that they have been unable to satisfy their requirements, not only for protein, but also for calories. The use of high-fat diets is still in an experimental stage at Mulago, but the rate of weight increase during recovery is at present being watched in children who are taking each day about 150 calories/kg. body weight — a much higher intake than has been achieved in most cases in the past.

The esterification of cholesterol is, like the synthesis of albumen, one of those processes that almost certainly occur in the liver. In kwashiorkor the correlation of the clinical condition with most of the tests believed to measure liver functions is disappointing, but it is usual to find at Kampala, in the cases judged on clinical grounds to be the most severe, a very low level of albumen in the serum proteins. In those cases, it has been observed that the level of esterified cholesterol in the serum is also very low, and the connection of the two observations is being studied.

The rises that occurred towards the end of the period of treatment cannot be satisfactorily explained. It is possible that they indicated a return towards good health with the restoration of normal powers of synthesis, but there are unfortunately no standard values at present available for healthy African children, and therefore no way of assessing their true significance. The simultaneous rise of all the lipid fractions to approximately the same degree suggests haemoconcentration, but the other available data for biochemical investigations on the same samples of serum do not support that suggestion. In another series of Kampala cases, THOMPSON (quoted by TROWELL, DAVIES and DEAN, 1954) found that treatment increased the amount of β-globulin present in the serum, and an attempt is being made to find whether this protein fraction varies with any of the lipid fractions. Hyperlipaemia in other diseases is usually accompanied by changes in β-lipoproteins but not in α-lipoproteins, and it will also be necessary to determine whether this is so in the hyperlipaemia found during the treatment of kwashiorkor. It has recently been established that in man, as in the rat, bile acids are the chief excretory product of cholesterol (SIPERSTEIN and MURRAY, 1955). It would be of interest to follow the rate of excretion of bile acids in kwashiorkor and to determine whether there are variations that could be correlated with the serum cholesterol.

SUMMARY

(1) The amounts of neutral fat, phospholipid, free and esterified cholesterol were determined in the serum of 20 children admitted for the treatment of kwashiorkor.

(2) Soon after the beginning of treatment, there were large increases in the amounts of neutral fat and esterified cholesterol.

(3) The possibility is discussed that the increases were principally due to the release of fat and cholesterol from the liver.

(4) The theory is put forward that in kwashiorkor the failure to mobilise fat may be more significant than the mere presence of fat in the liver.

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SEXUAL MATURATION AND VARIATION IN THE HEIGHT AND WEIGHT GROWTH OF BANTU GIRLS IN DURBAN*

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Children may pass through the period of sexual maturation at widely differing ages, some attaining physical maturity at an age when others are still infantile in this respect. Since development at puberty is associated with a well-defined growth pattern of acceleration followed by deceleration, it is necessary to consider the level of sexual maturation when assessing growth progress in the individual child. Previous studies of the growth of Bantu boys and girls in South Africa have not made allowance for the growth differences between children of the same chronological but differing maturity age (KARK and LE RICHE, 1944 ; KARK, E., 1953).

The present study is one of a series concerned with the growth of children in progress at the Institute of Family and Community Health, Durban. It is an investigation of the growth of Bantu girls in relation to their sexual maturation. The girls, studied, attended two schools in Lamontville, a municipal township of Durban, receiving a medical care service from the Institute. The vast majority of girls (92 per cent.) came from homes in the township, the remainder coming from neighbouring suburbs. The schools included an infant school with first and second grades only, and a junior school from standard 1 to 7, the former acting as a feeder school to the latter. The great majority of the girls were Zulu (72 per cent.), the remainder consisting of Sotho (7 per cent.), Xhosa (6 per cent.), Swazi (5 per cent.) and Baca, Nyasa and Pondo.

The first examination of the girls was carried out in June, 1950, and thereafter periodic examinations took place in November and December, just before the summer vacation, and in May and June, before the winter vacation, of the years 1950, 1951 and 1952. The initial examination included 365 girls. As new girls entered school each term they were included in the study, making a total of 578 girls by December, 1952, when this aspect of the investigation was concluded.

Four of the 578 girls have been excluded from the somatometric study in the present analysis. One of them died of tuberculosis soon after the study commenced, two were admitted to hospital for tuberculosis treatment during the study period, and the fourth girl had marked limb deformity following poliomyelitis in infancy. In some cases individual measurements were excluded from analysis due to errors in recording. Results of 1,983 individual examinations were therefore available for analysis.

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* This study was undertaken when the author was Senior Bursar, Family Health Research Unit, South African Council for Scientific and Industrial Research.

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METHODS

Clinical examination included :

(1) *Measurements of weight and height at six-monthly intervals.*

The girls, wearing bloomers only, were weighed and measured on an Avery personal scale with graduated metal upright and wooden headpiece. Measurements were made in the Metric System.

(2) *Assessment of Progress in Sexual Maturation.*

Observations of progress in breast development and pubic and axillary hair growth were made at six-monthly intervals, and at the same time each girl was interviewed as to the occurrence of the menarche in premenarcheal girls, or the periodicity of menses in those girls with menarche.

Maturity Grading. The girls were classified into the following maturity grades : *Non-pubescent* (N) : Those girls who showed no evidence of development of secondary sex characters and had not attained the menarche. *Pubescent* (P) : Those girls who showed development of any of the secondary sex characters (breast enlargement, pubic or axillary hair growth), but had not attained the menarche. *Adolescent* (A) : Those girls who had attained the menarche. They also evidenced further maturation in breast development and pubic and axillary hair growth.

Maturity grading was assessed at the initial examination. At the subsequent six-monthly examinations all the non-adolescent girls were re-examined for progress in their sexual maturation.

ANALYSIS OF FINDINGS

The present analysis is confined to the weight and height measurements of the girls in relation to : (1) their chronological age, (2) their maturity grade.

(i) *Maturity Grade and Chronological Age.* Table I and Graph 1 indicate the developmental status of the girls at the initial examination. They have been grouped by chronological age and maturity grade (non-pubescent, pubescent and adolescent) according to the criteria previously discussed. Of the 578 girls graded at the initial examination, there were 207 non-pubescent, 217 pubescent and 154 adolescent girls.*

The age range of girls who had not yet manifested any signs of pubescence was from 8 to 13 years. While only one 8-year-old girl was pubescent, no less than 14.1 per cent. of 9-year-olds, and 35.3 per cent. of 10-year-olds were pubescent. By the age of 11 years a minority of the girls remained non-pubescent, 72.5 per cent. being pubescent. Among the 12-year-olds there were 6.1 per cent adolescent, 83.3 per cent. pubescent and 10.6 per cent. non-pubescent girls. There were many more adolescents among the thirteen-year-olds (30 per cent.). Thereafter adolescents were the majority in each age-group (61.8 per cent. of the 14-year-olds and 93.8 per cent. of the 15-year-olds). It was only at the age of 16 years that all the girls were in the adolescent stage of maturation. Thus, within the age range of 9 - 15 years there were a number of girls of the same chronological age, but at different levels of maturation. There were non-pubescents and pubescents among the 9, 10 and 11-year-olds ; non-pubescent, pubescent and adolescent girls in the 12 and 13 year groups ; pubescent and adolescent in the 14 and 15 year groups.

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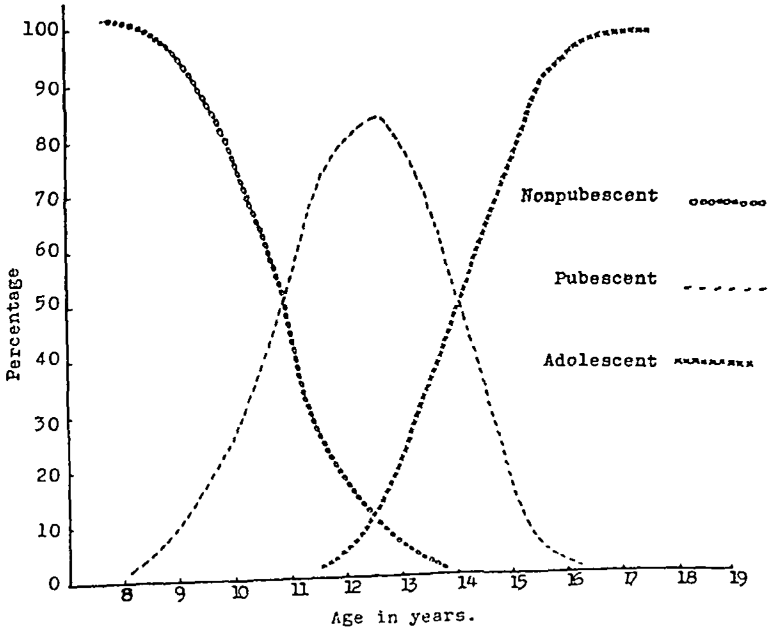
* Of the 424 non-adolescent girls in the original group, 95 attained the menarche during the 2½ year period of the study. The girls have since been followed up and by December, 1955, 294 (69.3 per cent.) have attained the menarche. The mean age at menarche of this group is 13.98 years (S.D. 2.26).

TABLE I. Distribution of girls according to chronological age and maturity grade at initial examination, (during the period 1950-52).

Age group in years.	No.	Non-pubescent	% Total	Pubescent	% Total	Adolescent	% Total
8–	64	63	98.4	1	1.6	—	—
9–	71	61	85.9	10	14.1	—	—
10–	85	55	64.7	30	35.3	—	—
11–	69	19	27.5	50	72.5	—	—
12–	66	7	10.6	55	83.3	4	6.1
13–	70	2	2.9	47	67.1	21	30.0
14–	55	—	—	21	38.2	34	61.8
15–	48	—	—	3	6.2	45	93.8
16–	23	—	—	—	—	23	100.0
17– 19	27	—	—	—	—	27	100.0
Total	578	207	—	217	—	154	—



GRAPH I. Percentage distribution of girls according to chronological age and maturity grade at initial examination.

(ii) *The Height and Weight of Girls according to Chronological Age.* Table II and Graphs 2a and 2b indicate the mean-heights and weights of the girls according to chronological age, irrespective of their stage of pubertal maturation. These are the accumulated six-monthly measurements of the 574 girls included in this analysis.

TABLE II. Mean heights and weights of girls according to chronological age. (accumulated 6-monthly measurements during the period June 1950 — December 1952)

Age	8–	8½–	9–	9½–	10–	10½–	11–	11½–	12–	12½–
No. in group	32	53	78	104	123	149	146	154	146	144
Height (cms.) Mean	124.53	126.08	128.70	130.05	131.93	134.40	135.96	139.85	142.46	144.70
S.E. Mean	.95	.72	.71	.60	.56	.52	.53	.56	.58	.60
S.D.	5.35	5.22	6.31	6.12	6.38	6.36	6.35	6.96	7.01	7.24
Weight (Kgm.) Mean	25.06	25.64	27.48	28.60	29.88	31.44	32.44	35.03	36.86	38.90
S.E. Mean	.56	.43	.48	.42	.43	.43	.47	.51	.58	.59
S.D.	3.11	3.11	4.25	4.30	4.78	5.23	5.64	6.28	7.04	7.14

TABLE II. Continued.

Age	13–	13½–	14–	14½–	15–	15½–	16–	16½–	17– 19½
No. in group	131	128	126	113	100	87	58	41	70
Height (cms.) Mean	147.65	149.92	151.50	152.68	154.60	155.20	154.40	155.55	154.95
S.E. Mean	.61	.57	.55	.58	.57	.60	.71	.79	.72
S.D.	7.03	6.44	6.13	6.16	5.74	5.64	5.37	5.11	6.00
Weight (Kgm.) Mean	41.52	44.23	46.49	47.38	49.04	51.36	52.96	53.98	56.72
S.E. Mean	.60	.61	.62	.63	.65	.74	.89	1.06	.87
S.D.	6.86	6.91	6.91	6.66	6.48	6.92	6.78	6.79	7.27

Height : It will be noted that there is a relatively steady increase in height from the age of 8 to 11 years. From 11 years of age to 13½ years there is an increased rate of growth compared with the 8 - 11 year group. After 13½ years the rate gradually slows and the difference in the height of girls between 15 and 16, and 16 and 17 years and over was negligible.

The increased standard deviation of the means between 11½ to 13 years indicates the wider variation around the mean at these ages, and suggests that the growth behaviour of girls during this period differs considerably from that occurring earlier and later than these ages.

Weight. The trend in weight growth is not the same as that of height. There is an increase in weight increment after the age of 11 years as compared with earlier measurements, but the weight growth does not show the same marked decline after the age of 15 years.

There is a steady increase in the standard deviation of the mean weight at each successive year from 8 to 12 years, thereafter remaining relatively high. This is in contrast to what has been noted in height growth, where the standard deviation decreased after the age of 15 years.

(iii) *The Height and Weight of Girls in relation to their Maturity Grade and Chronological Age.* When the girls are grouped according to their stage of sexual maturation as well as chronological age, a somewhat different picture is presented.

TABLE III. Mean heights and weights of girls according to chronological age and maturity grade

Maturity Grade	Age	8–	8½–	9–	9½–	10–	10½–	11–	11½–	12–	12½–
Height (cms.) Non-pubescent	No.	31	52	66	85	87	76	55	37	*21	*13
	Mean	124 25	125.95	128 18	129 40	130 05	131 20	132 50	134 95	—	—
	S.D.	5 25	5 15	6 32	5.77	5 55	5 56	6 01	5 61	—	—
Pubescent	No.	*1	*1	*12	*19	36	73	90	113	117	117
	Mean	—	—	—	—	136 55	137 70	137 89	141 15	142 95	144 85
	S.D.	—	—	—	—	5 96	5 36	5 42	6 59	6 92	6 75
Adolescent	No.	—	—	—	—	—	—	*1	*4	*8	*14
	Mean	—	—	—	—	—	—	—	—	—	—
	S D.	—	—	—	—	—	—	—	—	—	—
Weight (Kgms.) Non-pubescent	No.	31	52	66	85	87	76	55	37	*21	*13
	Mean	24 94	25 58	27 10	28 10	28 36	28 64	29 30	31 00	—	—
	S D.	3 07	3 10	4 24	4 27	3 82	3 78	3 90	4 27	—	—
Pubescent	No.	*1	*1	*12	*19	36	73	90	113	117	117
	Mean	—	—	—	—	33 56	34 36	34 16	35 94	37 42	38 70
	S D.	—	—	—	—	4 91	4 94	5 45	6 05	6 63	6 26
Adolescent	No.	—	—	—	—	—	—	*1	*4	*8	*14
	Mean	—	—	—	—	—	—	—	—	—	—
	S D.	—	—	—	—	—	—	—	—	—	—

* As there were a limited number of girls in these phases of development, their mean heights and weights have not been calculated.

From Tables II and III and Graphs 2a and 2b, it will be noted that the mean heights and weights of the non-pubescent girls are less than those of the total age group. This difference is slight between the ages of 8 - 10 years, becoming more marked from 10 - 12 years. The mean heights and weights of the pubescent girls are greater than those of the total group between 10 - 13 years of age, after which they become less than the total group mean from 13 - 15 years. Between 13 and 16 years, the heights and weights of the adolescent girls are greater than those of the total group, becoming identical with the latter after this time when all the girls have become adolescent.

A comparison of non-pubescent and pubescent girls aged 10 to 12 years, and of pubescent and adolescent girls aged 13 to 15 years, indicates considerable differences in their height and weight growth (Table IV, Graphs 2a, 2b).

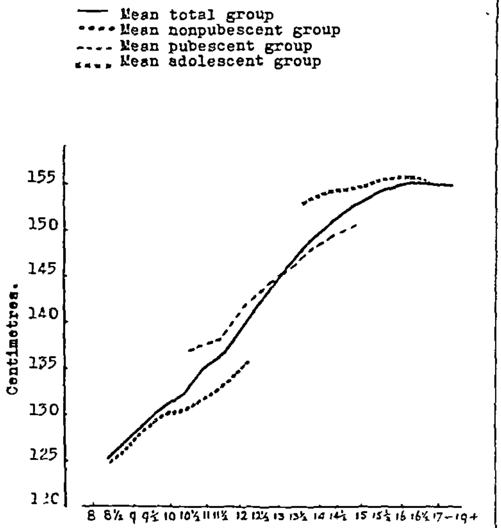
TABLE III. Continued.

Maturity grade	Age	13–	13½–	14–	14½–	15–	15½–	16–	16½–	17– 19
Height (cms.) Non-pubescent	No.	*3	*1	—	—	—	—	—	—	—
	Mean	—	—	—	—	—	—	—	—	—
	S.D.	—	—	—	—	—	—	—	—	—
Pubescent	No.	105	84	65	30	*11	*2	—	—	—
	Mean	147.00	148.20	149.25	150.35	—	—	—	—	—
	S.D.	7.00	6.27	5.41	5.52	—	—	—	—	—
Adolescent	No.	23	43	61	83	89	85	58	41	70
	Mean	152.07	153.55	153.90	153.50	154.90	155.45	154.40	155.55	154.95
	S.D.	4.77	4.95	6.01	6.19	5.70	5.47	5.37	5.11	6.01
Weight (Kgms.) Non-pubescent	No.	*3	*1	—	—	—	—	—	—	—
	Mean	—	—	—	—	—	—	—	—	—
	S.D.	—	—	—	—	—	—	—	—	—
Pubescent	No.	105	84	65	30	*11	*2	—	—	—
	Mean	40.38	42.08	43.46	43.14	—	—	—	—	—
	S.D.	6.24	5.94	6.29	5.61	—	—	—	—	—
Adolescent	No.	23	43	61	83	89	85	58	41	70
	Mean	48.04	48.82	49.72	48.92	49.68	51.87	52.96	53.98	56.72
	S.D.	5.42	6.19	6.05	6.37	6.37	6.75	6.78	6.78	7.27

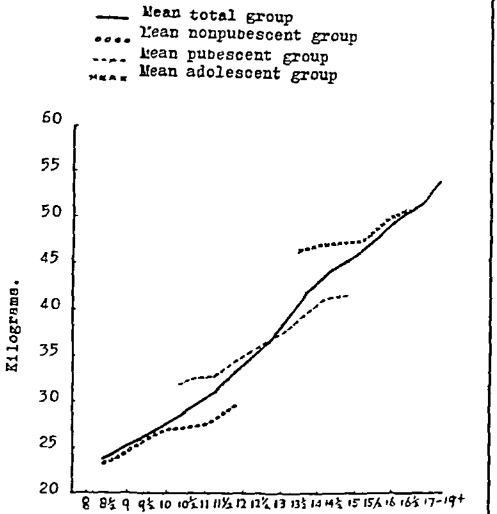
* As there were a limited number of girls in these phases of development, their mean heights and weights have not been calculated.

In each half-year age group, 10, 10½, 11 and 11½ years respectively, the pubescent girls were significantly taller (by 5 - 6 cm.) and heavier (by 4 - 5 Kgm.) than the non-pubescent girls. Similarly, the adolescent girls were significantly taller (by 3 - 5 cm.) and heavier (by 5 - 8 Kgm.) than the pubescent girls in the 13, 13½, 14 and 14½ year age groups.

GRAPH 2a. Mean heights of girls according to chronological age and maturity grade.



GRAPH 2b. Mean weights of girls according to chronological age and maturity grade.



The more mature girls were at least 1½ years in advance in their height and weight measurements as compared with those less mature. The 10-year-old pubescent girls were taller and heavier than the 11½-year non-pubescent girls, and the 13-year adolescent girls were taller and heavier than the 14½-year pubescent girls.

DISCUSSION

The significance of the relationship between sexual maturation and the growth of children and its application in their health assessment and medical care, has been indicated in a number of studies. (CRAMPTON, 1908 ; DAVENPORT, 1926 ; BOAS, 1932 ; DIMOCK, 1935 ; PRYOR, 1936 ; STONE and BARKER, 1937 ; SHUTTLEWORTH, 1937 ; GREULICH, 1941; SIMMONS and GREULICH, 1943 ; ELLIS, 1946, 1947 ; STUART, 1947 ; WILSON and SUTHERLAND, 1949 ; JONES and BAYLEY, 1950 ; BRYAN and GREENBERG, 1952 ; BAYLEY, 1956). Although these and other workers have stressed the importance of the maturational factor in child growth studies, many growth tables continue to be based on the mean growth according to chronological age only. This may not be of great significance in the younger, more homogeneous age-groups when pubertal change is not yet evident. In the older age-groups, however, where there is heterogeneity in the level of sexual maturation attained

TABLE IV. Height and weight differences in girls of similar chronological ages but differing maturity grades.

(a) Comparison of non-pubescent and pubescent girls.

Age group	Maturity grade	Heights (cms.)					Weight (Kgms.)			
		No.	Mean	Diff. means	S.E. diff.	Diff. / S.E. Diff.	Mean	Diff. means	S.E. diff.	Diff. / S.E. diff.
10 years–	Non-pubescent	87	130.05	6.50	1.158	5.6	28.36	5.20	.9152	5.7
	Pubescent	36	136.55				33.56			
10½–	Non-pubescent	76	131.20	6.50	.8946	7.3	28.64	5.72	.7227	7.9
	Pubescent	73	137.70				34.36			
11–	Non-pubescent	55	132.50	5.39	.9915	5.4	29.30	4.86	.7789	6.2
	Pubescent	90	137.89				34.16			
11½–	Non-pubescent	37	134.95	6.20	1.095	5.7	31.00	4.94	.9037	5.5
	Pubescent	113	141.15				35.94			

(b) Comparison of pubescent and adolescent girls.

13–	Pubescent	105	147.00	5.07	1.207	4.2	40.38	7.66	1.284	6.0
	Adolescent	23	152.07				48.04			
13½–	Pubescent	84	148.20	5.35	1.019	5.2	42.08	6.74	1.145	5.9
	Adolescent	43	153.55				48.82			
14–	Pubescent	65	149.25	4.65	1.021	4.6	43.46	6.26	1.100	5.7
	Adolescent	61	153.90				49.72			
14½–	Pubescent	30	150.35	3.15	1.215	2.6	43.14	5.78	1.240	4.7
	Adolescent	83	153.50				48.92			

by children of similar chronological age, such average growth curves are of limited value in growth appraisal of the individual child. BAYLEY (1956) has recently made use of growth charts which have been constructed to allow for variation in height and weight according to the child's maturational level. By this means the use of growth standards in the assessment of progress of individual children is considerably enhanced.

The present study of Bantu girls demonstrates the significant differences in weight and height growth in girls of the same age, but differing maturity grade, and indicates the need for developing similar growth curves for use in clinical practice among the varied peoples of this country.

In each half-year age group, 10, 10½, 11 and 11½ years respectively, the pubescent girls were significantly taller (by 5 - 6 cm.) and heavier (by 4 - 5 Kgm.) than the non-pubescent girls. Similarly, the adolescent girls were significantly taller (by 3 - 5 cm.) and heavier (by 5 - 8 Kgm.) than the pubescent girls in the 13, 13½, 14 and 14½ year age groups.

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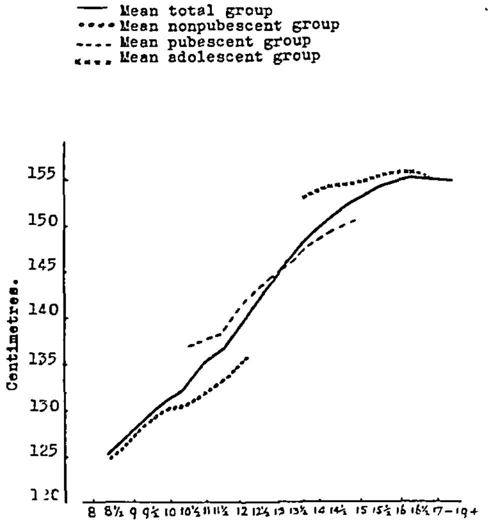
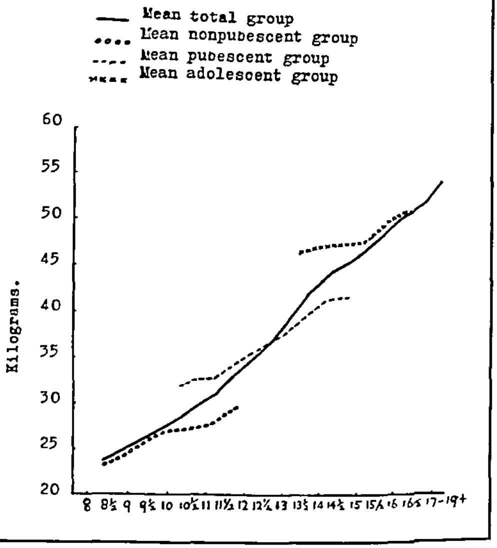


Graph 2b. Mean weights of girls according to chronological age and maturity grade.



The more mature girls were at least 1½ years in advance in their height and weight measurements as compared with those less mature. The 10-year-old pubescent girls were taller and heavier than the 11½-year non-pubescent girls, and the 13-year adolescent girls were taller and heavier than the 14½-year pubescent girls.

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10 years–	Non-pubescent	87	130.05	6.50	1.158	5.6	28.36	5.20	.9152	5.7
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10½–	Non-pubescent	76	131.20	6.50	.8946	7.3	28.64	5.72	.7227	7.9
	Pubescent	73	137.70				34.36			
11–	Non-pubescent	55	132.50	5.39	.9915	5.4	29.30	4.86	.7789	6.2
	Pubescent	90	137.89				34.16			
11½–	Non-pubescent	37	134.95	6.20	1.095	5.7	31.00	4.94	.9037	5.5
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(b) Comparison of pubescent and adolescent girls.

13–	Pubescent	105	147.00	5.07	1.207	4.2	40.38	7.66	1.284	6.0
	Adolescent	23	152.07				48.04			
13½–	Pubescent	84	148.20	5.35	1.019	5.2	42.08	6.74	1.145	5.9
	Adolescent	43	153.55				48.82			
14–	Pubescent	65	149.25	4.65	1.021	4.6	43.46	6.26	1.100	5.7
	Adolescent	61	153.90				49.72			
14½–	Pubescent	30	150.35	3.15	1.215	2.6	43.14	5.78	1.240	4.7
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by children of similar chronological age, such average growth curves are of limited value in growth appraisal of the individual child. BAYLEY (1956) has recently made use of growth charts which have been constructed to allow for variation in height and weight according to the child's maturational level. By this means the use of growth standards in the assessment of progress of individual children is considerably enhanced.

The present study of Bantu girls demonstrates the significant differences in weight and height growth in girls of the same age, but differing maturity grade, and indicates the need for developing similar growth curves for use in clinical practice among the varied peoples of this country.

SUMMARY

(1) The present paper reports weight and height growth in Bantu school girls of Durban in relation to their level of sexual maturation.

(2) At the initial examination and at each subsequent half-yearly examination the girls were graded, according to their stage of sexual maturation, as non-pubescent, where there were no signs of pubertal development ; pubescent where development of secondary sex characters was in progress ; adolescent when the menarche had been attained.

(3) The mean heights and weights of the girls is shown (a) in relation to their chronological age and (b) in relation to chronological age and maturity grade.

(4) While the measurements according to chronological age indicate increased growth rates from 11 to 14 years, it is only when this is considered in terms of maturity grade that the significance is revealed.

(5) Pubescent girls in each half-year group between 10 and 12 years are taller and heavier than the less mature non-pubescent girls of the same age-group. Similarly, adolescent girls between 13 and 15 years are taller and heavier than pubescent girls of the same age. In each age-group the more mature girls are at least 1½ years in advance of their less mature schoolmates.

(6) The need to consider the individual child's maturational development as well as the age in the appraisal of growth is indicated by these findings. Growth charts allowing for these variations in maturation would thus be of considerable assistance in clinical practice.

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MATERNAL AND CHILD HEALTH SERVICES IN S.E. ASIA
(V) THAILAND

by

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The population of Thailand is approximately 20,000,000. about 80% of whom live in rural areas. The country is divided into 71 provinces and 417 districts. At present there is one provincial health officer in each province, and of these five have assistants.

The crude birth rate in 1954 was reported to be 34.2 per thousand, the crude death rate 9.7 per thousand, the infant mortality rate 63.5 per thousand live births. the maternal mortality rate 6 per thousand and the premature rate 7 per cent.

However, these figures, in common with those from many tropical countries, must be regarded as inaccurate approximations.

The nutritional status, with the exception of the north-eastern part of the country, is better than in any other country of the S.E. Asia region. A recent concentrated effort by the government, with internal assistance, to reduce the incidence of malaria and yaws has contributed a great deal to the improvement of the health of the population.

(1) *Administration.*

Maternal and child health activities are administered on the government level by the Divisions of Maternal and Child Health and of Rural Health, which are under the Deputy Director of Public Health. In addition to health centres, the government also supervises 11 mobile car teams and 2 mobile boat teams. MCH work in municipalities is not under the authority of the government.

On the provincial level there are no MCH officers, and the work is supervised by nurse-midwives who have been trained for six months to become " provincial nurse-supervisors." Up till now 37 have been appointed and 15 more are under training.

(2) *Health Centres*

With the exception of a pilot MCH project in Bangkok, originally assisted by the World Health Organisation and the United Nations Children's Fund, maternal and child health activities are the responsibility of Health Centres. A Health Centre combines maternal and child health work with a certain amount of medical care and environmental sanitation. A " first class " centre covers about 10,000 population and a " second class," 5,000. There are altogether in the country 40 first class centres, 655 second class centres and 51 municipal first class centres, providing between them some sort of service to a population of four million.

The Journal of Tropical Pediatrics, June, 1957

The staff of a first-class centre consists, theoretically, of : 1 doctor, 1 nurse, 1 midwife and 1 sanitarian. The staff of a second class centre : 1 midwife, 1 sanitarian, who is actually a second class medical practitioner. The difference between a first and a second-class centre is in the quality of the personnel only.

Thirty-three doctors are at present assigned to first class health centres. In addition there are five doctors each in two rural health pilot projects in Chiengmai and Cholburi. Those centres, which have no full-time doctor, are served part-time by the provincial health officers or their assistants.

At present the following auxiliary personnel is engaged in the work of the health centres : 13 nurses in first-class rural health centres, 26 in the Bangkok MCH Project and 8 in the Chiengmai Rural Health Pilot Project. Sixty midwives work in first-class centres and 645 in second-class centres. The number of sanitarians in the two types of centre are sixty and 618.

Buildings are as a rule adequate and recently most of the 655 second-class centres have been provided with accommodation for their staff.

The average number of deliveries conducted in a centre per month is 7. There are usually 2 clinic sessions per week, one for ante-natal and one for children's care. The work of a typical centre is illustrated in Table I.

TABLE I. Activities of typical MCH clinic during an average month.

	Clinic attendances.	*Home visits*
Infants	20	20
Children	24	20
Mothers	30	30
Pregnant women	35	30
Others	150	—

(3) *Mobile Maternal and Child Health Units*

These units were established in 1950 with the purpose of visiting areas not served by State services. While a unit works in a certain province, the provincial health officer functions as head of the service. The permanent staff consists of two second-class midwives and staff operating a film unit, which shows health education films.

There is also one more elaborate mobile unit in the Pra-Chuabkirikan province donated by His Majesty the King. This unit has its own medical officer and nurse.

(4) *School Health Services*

School health is directed by a separate division, which runs a central general and dental clinic in the capital.

A number of nurses are attached to the 126 schools of Bangkok and they are supervised by four doctors. In addition, one school health doctor works at the MCH pilot project. Two doctors supervise school health activities in a previously WHO-assisted School Health Project in Chacherngsao and one works in connection with the UNESCO Fundamental Education Project in Ubol.

Except for this, all school health work is conducted on a mobile basis. There are 5 mobile school health units for the provinces of Korat, Chiengmai, Songkla, Ubol and Kanchanaburi. Each team consists of one doctor, two assistant nurses and two dental hygienists. A team has two jeeps at its disposal.

The School Health Pilot Project in Chacherngsao emphasizes training of teachers in health activities and integration of school health in general community health services.

(5) *Psychological care*

The first child guidance clinic in Thailand was established in Bangkok in 1955. The staff consists of two psychiatrists and one psychiatric social worker.

The World Health Organization has provided a psychologist to assist in the development of psychological services. In addition, the UNESCO Thai branch of the International Institute of Child Study carries out research on normal school children.

(6) *Maternity Services*

The major part of the skilled maternity care is given by the health centres. In addition to these, there are also 149 " midwife service centres," staffed by one midwife each.

Most deliveries are still conducted by indigenous, untrained birth attendants, called *moh-tam-yaes.* There appear to be some 30,000 of these practising in the country, out of whom about one third are males. The *moh-tam-yaes* usually provide home-help, in addition to conducting the delivery. Recently, training of these workers in hygiene and safe techniques is being attempted. Nurse supervisors, specially prepared for this purpose will each train 100 *moh-tam-yaes* a year in courses of 2 weeks. After training, the *moh-tam-yaes* will remain under the supervision of the midwives of the health centres.

Obstetric hospital services are limited to Bangkok and a few towns. The total number of obstetric beds in Bangkok is 405 and the number of obstetricians on the staff is 31, out of whom 14 are employed by the medical university. The total number of deliveries conducted in hospitals in Bangkok during the year 1955 was 25,941, which is roughly 70 per cent. of the total number of births in the capital.

(7) *Pediatrics*

There are about 20 pediatricians with post-graduate training in the country. There are no separate pediatric departments outside Bankok. The Siriraj University Hospital has 100 beds and a monthly attendance of 4,000 in the out-patients department. The Chulalongkorn Red Cross Hospital, affiliated with the medical university, has 60 beds and a monthly out-patients' attendance of 2,500. Recently a 160 bedded children's department has been opened in the new women's and children's hospital. Total admissions in all children's departments in Bangkok in 1955 were 9,611.

Pediatrics is taught at the University of Bangkok during the last three years of the six-year medical course. The number of hours allotted to this subject are : 11 in the fourth and fifth years and 100 in the sixth year (out of which 12 are lectures, including two hours of child psychiatry, and the rest practical demonstrations).

(8) *Personnel*

There is a shortage of doctors outside Bangkok and the few towns, and, as a result, the bulk of the work is done by so-called sanitarians, of whom there are 925 in the whole country. The sanitarians usually have extensive private practices and are held in high esteem by the population.

The majority of the 1,029 midwives in Thailand have had one year's training, based on an educational standard of 4 years' primary school. Since 1952 the duration of the course has become 18 months, and 3 years secondary school is required for admission. The present number of graduates is 150-160 per year. In addition to the schools in Bangkok (established 1939), and Chiengmai (established 1954), two more are planned, one each in the east and south of Thailand. Candidates are selected from various rural *Amphur* (districts) of each *Changvad* (provinces) ; after completion of their courses, graduates are bound to return to work in their home towns or villages.

The number of trained nurses in Thailand is 213 and most of them are employed in hospitals. In order to upgrade the services a new category of nurse-midwives was created in 1954. The course lasts 3½ years. The first batch of 57 will graduate in 1957. The School of Public Health in Bangkok trains public health nurses in a two-year post-graduate course.

CORRESPONDENCE

To the Editor

(1) RICKETS IN THE TROPICS

SIR,—The article by Dr. E. STRANSKY (Vol. I, p. 232) and the letter from Dr. A. R. P. WALKER (Vol. II, p. 169) are of great interest. Too little attention has been paid to rickets, although I think that in some areas it is an important underlying cause of a number of cases of respiratory and gastro-intestinal disease. Vitamin D contents are omitted from the " Food Composition Tables — Minerals and Vitamins, for International Use," published by FAO, March 1954, and also from the Medical Research Council Special Report : 253 " Tables of Representative Values of Foods Commonly used in the Tropics " by Professor B. S. PLATT. In the tropics one rarely sees adults with old rickets, because so many of them have died in infancy.

It is difficult to understand why rickets should be so rare in Manila, when in Singapore it is, or was, a very common condition. Out of 200 consecutive admissions to the Children's 2oc Ward in 1939, 118 had clinical evidence of rickets, and, in 81 of these, rickets was confirmed by radiology and/or histological examination.

Dr. STRANSKY considers that the high incidence of rickets in coloured children in Baltimore is due to pigmentation. It is possible too that these children have more clothing and less sun-and-airing than the Whites, as pointed out by Dr. WALKER for Johannesburg. In many places harm is done by trying to preserve a fair complexion.

I believe that cases of rickets may show a normal blood calcium and phosphorus. It is the lack of vitamin D that prevents their utilization. It is usually easy to distinguish between the x-ray pictures of active, of healing, and of healed rickets, although many radiologists in the tropics have had as yet little experience with this. But an x-ray will not show early rickets. Many cases that come to autopsy will demonstrate the histological changes of rickets which have shown nothing abnormal radiologically.

A low blood calcium by itself produces tetany and not rickets, unless there is also a deficiency of vitamin D. The most severe rickets is often found in fat " well-nourished " babies, in whom it may start very young, and in whom it is difficult to palpate, and even more difficult to see, costo-chondral enlargement. The more rapid the growth, the more severe the rickets. These babies are very apt to die from intercurrent infections, or to develop anaemia, but they generally respond well to treatment with vitamin D or with ultra-violet radiation, or gradual exposure to sunlight.

BICKNELL and PRESCOTT (The Vitamins in Medicine, 1953, London, p. 527) sum up the position as follows : " In man and dogs, rickets occurs on normal diets if vitamin D alone is deficient, but even here the calcium and phosphorus of the diet is a deciding factor in the amount of vitamin D that will prevent rickets. As they become more unbalanced in the diet, so does the amount of vitamin D required increase."

Finally may I refer to my article on " Rickets in Singapore " (Arch. Dis. in Ch. 1946, 21, 37). On p. 48 there is a good illustration of rapid healing in a severely affected child. In many such cases the calcium and phosphorus levels were within normal ranges.

(2) MONGOLISM IN NON-CAUCASIANS

Speaking incautiously from general impressions and not from any records, I should say that mongolism occurs in the following races in the following order of frequency : (1) Chinese, (2) Caucasians, (3) Africans, (4) Malays, (5) Indians.

The frequency with which the condition is identified will depend largely on (a) the incidence of paediatricians, and (b) the popularity and extent of child health services. In many areas very few of these children live beyond 6 years.

London CICELY D. WILLIAMS.

BOOK REVIEWS

Health, Culture and Community by various authors (Editor : Benjamin D. Paul). 1955. New York : Russell Sage Foundation. $5 (approx £1 15s 0d)

Cultural Difference and Medical Care by Lyle Saunders. 1954. New York : Russell Sage Foundation pp 317. $4.50 (approx $1 11s. 0d)

Culture, Psychology and Human Values by M. K Opler. 1956. Springfield, Illinois : Charles C. Thomas. pp. 242.

These three volumes may be best reviewed together as they all are bound up with the very valuable present-day trend towards the realization that public health and medicine cannot be practised *in vitro*, but only in the context of the reality of the local culture pattern

Perhaps the best of the three is the anthology edited by Dr. Benjamin Paul — in fact it deserves to become the teaching classic in its field The basic principle of the book is summarised in the introduction, where it is pointed out that " If you wish to control mosquitoes, you must learn to think like a mosquito " — and, similarly, if one wishes to help a community improve its health, one must learn to think like people in this community. In order to demonstrate the importance of this type of approach, Dr Paul has collected together 16 papers contributed by public health workers in widely scattered parts of the world Each of these demonstrates problems that can arise as a result of the conflict between indigenous cultural attitudes and attempts to introduce scientific public health While all the examples are of great interest, the following are especially relevant to the practice of preventive maternal and child health — " Diphtheria immunisation in a Thai community," " Birth control clinics in crowded Puerto Rico " and " A comprehensive health program among South African Zulus." All in all, this publication cannot be recommended too highly

The book by Dr. Lyle Saunders explores the same type of problem as the first, but in greater detail and in a relatively limited, though huge, area. Briefly, it is concerned with describing the difficulties inherent in supplying so-called " Anglo " health services to the 2½ million Spanish-speaking people living in the American Southwest. However, as the publishers note, although its examples are drawn from this culturally distinct population, the same principles would apply equally well to any cultural group in any geographical setting. In particular, it is concerned with differences in beliefs, values and attitudes which often account for patient or family reactions that are difficult for medical personnel to understand It is of great value to the tropical pediatrician, who may often be working in an unfamiliar culture

The third volume is written by Dr. Opler and is concerned with the realisation that mental ill-health, whether in children or adults, is related to the particular pressures, values and cultural norms of the particular group. With this in mind, the author reviews present knowledge of the incidence and types of mental disease in various cultures today, and attempts to correlate these with differences in cultural emphasis, including, incidentally, methods of child-rearing While the book is certainly a scholarly one covering a wide area of knowledge that bridges the gap between the disciplines of the psychologist, the community health worker and the socio-anthropologist, it has the disadvantage that, in contrast to the two previously mentioned publications, the vocabulary used by the author is often somewhat indigestible and difficult to follow.

Physiology and Pathology of Infant Nutrition by L. F. Meyer and E. Nassau. 1955. Sptingfield, Illinois : Charles C. Thomas. pp. 533.

Two leading Israeli pediatricians have collaborated in the production of this book, which has been translated from German, in which language it first appeared. Perhaps, because of this, some of the words are rather " quaint " — sometimes making for more vividness of expression than if the stereotyped medical jargon were used, but sometimes being rather irritating (as, for example, " irrigoscopy " for barium enema. " intraossal infusion " for " bone marrow infusion " etc.)

The main interest of the book is that it represents the teaching of one school of present-day Continental European pediatrics which is very much influenced by the teaching of Czerny and Finkelstein — as judged by the " eutrophic-dystrophic " classification used etc. While, then, it cannot be recommended as a standard text of infant nutrition for teaching purposes, it is certainly of great value for a library of a unit engaged in problems in this field, largely because of the different slant given to some facets of the subject.

An excellent feature is the considerable length (20 per cent. of the whole book) devoted to the interrelation of diarrhoea and malnutrition. A criticism is that no attention is paid to the special problems of infant feeding and nutrition of such lower socio-economic groups as are to be found amongst " oriental " immigrants into Israel.

Jordan's Tropical Hygiene and Sanitation by W. Wilkie. 1956. London : Balliére, Tindall and Cox. pp. 408.

This excellent little book is intended for use in training junior health staff in tropical regions. With language difficulties in mind, it has rightly been kept as simply written as possible.

There is no doubt that, accompanied by verbal instruction and explanation (as the author is careful to point out). this is a valuable, yet economical publication. However, there are certain criticisms which can be made. Briefly, while the more traditional aspects of public health — including such important topics as water supply, building construction, refuse disposal etc. — are well covered, certain social aspects of the subject do not receive as much emphasis as they deserve. In particular, the section on Health Education is very much biased to old-style didactic methods and the part dealing with teaching of health in schools is not well done. Lastly, more mention should be made of the types of personal public health services which are being developed, including the MCH clinic, the rural health clinic, the mobile unit, etc.

Biological Staining Methods by George T. Gurr. 1957. London : G. T. Gurr. pp. 102.

The sixth edition of this practical booklet is as useful as its predecessors and, within its 102 pages, full details of the various common and unusual staining techniques can be found clearly described. From the viewpoint of the tropical worker, the various staining methods employable for the diagnosis of malaria, filariasis and trypanosomiasis are clearly given. This short book is well produced, clearly illustrated and inexpensive.

EXCERPTS

Biologically False Positive Reactions to Serological Tests for Syphilis

(G. H. Konstant. *Bull. Wld. Hlth. Org.*, 1956, **14**, 235)

The frequency of biologically false positive reactions to serological tests for syphilis depends on a number of factors, including the individual immunological response, the number and type of serological tests performed, and the stage of the disease producing such reactions. The relative importance of such factors is discussed under different circumstances, including childhood. The author divides biologically false positive reactions into two groups — acute and chronic. Various " verification " tests are discussed.

Observations on Hyaline Membrane Disease in Jamaica

(J. D. Arneaud and G. Bras. *West Indian med. J.*, 1956, **5**, 175)

In Jamaica, the problem of hyaline membrane disease in the newborn has been found to be a significant one. Some cases appear to occur with no antecedent history of oxygen therapy.

On the Pathogenesis of Anaemias and Leukopenias Induced by Dietary Protein Deficiency

(A. Aschkenasy. *Amer. J. Clin. Nutr.*, 1956, **5**, 14)

A deficiency of protein induces anaemia and leucopenia not only because it deprives the haematopoietic organs of the amino-acids necessary for new cell formation and especially for haemoglobin production, but also because it reduces the tissue stores of certain haematopoietic factors (vitamin B_{12}, folic acid, nicotinic acid) and because it creates a hormonal imbalance : especially an inactivation of the thyroid and gonads and a relative hyperactivity of the adrenal cortex.

Measles : A Common Cause of Blindness in Sekhuniland

(J. H. Wessels and J. A. Pratt-Johnson. *Medical Proceedings* (Cape Town), 1956, **2**, 587)

Severe ocular complications of measles, including blindness, occur relatively frequently in Sekhuniland. It is considered that associated malnutrition is probably responsible.

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100 Cases of Cerebral Malaria

(H. Rothe. *East African med. J.*, 195633, , 405)

In Kisumu, Kenya, cerebral malaria is much commoner in children, especially below 5 years of age. Emergency treatment is suggested with an immediate intramuscular or intravenous injection of chloroquine diphosphate (approx. 10 mgm./kgm.), followed by a 5 per cent. glucose or Ringer's solution intravenous drip containing about the same quantity of chloroquine. This form of therapy is usually successful.

The Journal of TROPICAL PEDIATRICS

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EDITORIAL

PEDIATRIC EDUCATION

Pediatrics as an independent discipline is a relatively new concept in the Western world — and is newer still in most tropical countries. It is, then, with great interest that one welcomes an authoritative Report by a widely representative WHO panel of experts on the subject of pediatric education, which should be carefully studied by all concerned with the teaching of any aspect of child health.(1)

The Report rightly stresses that course content, curricula and methods employed will have to be varied to suit both local problems and facilities, but, at the same time, suggests the main guide-lines and also the type of philosophical approach. Initially, the overwhelming arguments in favour of pediatrics meriting the status of a full independent teaching " subject" are enumerated and discussed, and the general content of a pediatric teaching programme outlined. The breadth of the scope suggested is wide, and, as well as due emphasis on the diagnosis, treatment and prevention of disease in infancy and childhood, such other topics as the physical and physiological aspects of growth and development, infant and child nutrition, methods of examination of children, the art of handling children and their parents, problems of the handicapped child and other aspects of social pediatrics, are discussed.

The time allotment for pediatrics in an undergraduate course is debated, and there is a very useful description of teaching methods, which, as is noted, apply equally well to any clinical subject. There is a good discussion of the advantages and otherwise of such methods of instruction as lectures, group discussions, hospital and outpatient clerking, extra-mural training, the use of preceptors and other miscellaneous teaching methods, including the clinico-pathological conference and the modern usage of audio-visual aids. Of perhaps even greater interest is the emphasis given to the obviously needed, but rarely practised, course evaluation. Various suggestions as to methods of assessing the worth of a teaching programme are made.

Specialised post-graduate training in pediatrics is fully dealt with under the following general headings — the clinical pediatrician, the public health specialist in child health, " limited training in areas of special need," and " continuing education in pediatrics for the practising physician." The Report then concludes with two shorter sections on the organisation and relationships of a department of pediatrics, and the role of International Agencies in promoting improvement in pediatric teaching.

The World Health Organisation and the members of the Study Group are to be congratulated on this full, informative and vigorous account of present views on pediatric education, which certainly deserves the widest circulation and publicity. Perhaps the only minor criticism is that, while due emphasis is given to the need for variation to suit each local situation, the necessity — especially for the tropical pediatrician in a non-Western culture zone — of receiving instruction in elementary socio-anthropology is not noted. The need for this is, in fact, very great, as so much of his subsequent work will be enmeshed with local practices and attitudes, especially, for example, with regard to such fundamental topics as infant feeding and child rearing.(2)

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SURVEY FOR SERO-IMMUNITY TO POLIOMYELITIS IN PERU AND COLOMBIA*

(With Comments on the Changing Pattern of Occurrence of Poliomyelitis in Tropical Areas)

by

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During the past decade, there has been a very great increase in interest in poliomyelitis in tropical parts of the world. This has been due to the rather recent appearance of this disease in epidemic form in countries where it had previously been known only as an infrequent and sporadic cause of illness in young, native-born children and in older foreign residents (Gear, 1955). As recently as 1948, in a review of the world prevalence of poliomyelitis, Rhodes (1948) was able to mention only a few exceptions to the general rule that in the countries of Asia, Africa, and Central and South America this disease was infrequently seen, and then usually only in the form of sporadically encountered paralytic residua. Very soon thereafter, however, severe epidemics were reported in India, Israel, Angola, Belgian Congo, French Equatorial Africa, and Tahiti (Gear, 1955). In the western hemisphere, Puffer (1955) reported the incidence of poliomyelitis from 1945 through 1954 and indicated a trend to generally increasing rates in this part of the world, as well as the recent occurrence of epidemics in Puerto Rico (1946), Jamaica and Trinidad (1954), Cuba (1946 and 1952), Nicaragua and El Salvador (1953), Costa Rica (1954), Panama (1950-1951), Brazil and Argentina (1953), and Chile (1950 and 1954). Some other countries, such as Mexico, Venezuela, and Uruguay maintained a moderate level of endemicity with occasional peaks in occurrence, whereas in the remainder, including Peru and Colombia, poliomyelitis had not yet become of serious concern. More recently, in 1956 Argentina suffered an epidemic perhaps unprecedented in Latin America with 2,200 paralytic cases in Buenos Aires and its suburbs (Whittenberger and Ferris, 1956). Also in 1956, Colombia had its first experience with epidemic poliomyelitis in Cali.

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Because it had not been of great importance, poliomyelitis has been subjected to rather little investigation of its epidemiological and endemiological characteristics in the countries to the south of the United States. Only a few epidemics have been studied and reported in detail, as for example, Puerto Rico in 1954 - 1955 (PONS, 1956), Argentina in 1956 (WHITTENBERGER and FERRIS, 1956) and Costa Rica and Jamaica in 1954 (PAYNE and FREYCHE, 1956). These studies all showed a marked concentration of cases among young children, although there were some notable points of difference. The Argentina outbreak most justified the use of the term "infantile paralysis," with the morbidity rate in children below one year of age greatly exceeding that for all older age groups. In Jamaica and Costa Rica, the group 1 to 4 years of age suffered as severely as did the infants, and in Puerto Rico, the peak occurrence was attained in the group 1 to 2 years old. Only in Jamaica was there a significant, although much lower, occurrence of disease in adults. This age pattern, with young children being predominantly affected, is characteristic of outbreaks of poliomyelitis in the early phase of its evolution (PAUL, 1955).

Type 1 poliovirus has been the agent most frequently isolated from the stools of paralytic patients, although types 2 and 3, as well as other unidentified enteric viruses, have been recovered. A recent report (PAYNE and FREYCHE, 1956) gives the results of about 300 strains isolated from patients under epidemic conditions in South American countries, mainly Chile. 90 per cent. were polioviruses, of which 80, 15, and 5 per cent. were types 1, 2 and 3 respectively ; the remaining 10 per cent. were unidentified. This distribution is remarkably similar to that found in 794 isolations from patients in the United States in 1952, i.e. 80, 14, and 6 per cent. of types 1, 2 and 3 respectively (SHELOKOV et al., 1955). It is notable also that the percentage distribution of types was about the same for both paralytic and non-paralytic patients. Virus isolations from patients during inter-epidemic periods in Latin America showed a greater proportion of types 2 and 3, suggesting that the paralytogenic potential of strains of these latter types remains more or less constant, but that type 1 strains of increased virulence may periodically appear and their wide dissemination results in the epidemic occurrence of the disease. Isolations of polioviruses from healthy Latin American children have apparently been made only on a survey basis in Mexico (RAMOS-ALVAREZ and SABIN, 1956). Here types 1, 2 and 3 were found in 5, 22 and 75 per cent. respectively. When children were studied in a longitudinal fashion over a period of 3 years in southern Louisiana (FOX et al., 1956) all three types were found in almost equal numbers. Serological surveys in many parts of the world indicate that the latter finding must represent the natural occurrence of these viruses, further attesting to the greater frequency of virulent strains within type 1.

Surveys of sero-immunity to poliomyelitis have been conducted in Venezuela (CORIELL et al., 1956) and Brazil (DA SILVA and SYVERTON, 1956). In Caracas, children of very low economic status and up to 7 years of age were studied. Neutralizing antibodies of all three types were demonstrated in a very high percentage, the mean for the three types being 77 per cent. in children 2 years old or less. 45 per cent. of children of this age had antibody to all three types, and by 6 years of age this figure had risen to 78 per cent. In Rio de Janeiro, following the 1953 epidemic, children of 3 differing socio-economic levels were sampled but unfortunately each in a different age-group. High percentages of immunes were also demonstrated here (a mean of 81 per cent. in the poorest children who averaged 8 years old), and it was shown that the percentage of immunes declined with rising standards of living.

Since information relating to the sero-immune status to poliomyelitis had not been completely developed for any South American population, it seemed worthwhile to make a survey of neutralizing antibody in situations where paralytic poliomyelitis had not yet appeared as a serious problem. These data might then become of even greater interest and significance if, or when, epidemics of the disease do occur in the future. Accordingly, approximately 1,650 sera were collected from healthy persons of all ages at various localities in Peru, and in Cali, Colombia. Of these, 1,430 sera were found suitable for testing and are reported below. Some of these blood specimens were collected originally in a study of the epidemiology and control of typhus in the Andean Indians (MONTOYA et al., 1955) ; the majority were obtained by local physicians for the present purpose only.

METHODS AND MATERIALS

Population data

Peru : Five distinct population groups were sampled. Lima, the capital city with a population of about 1,000,000, is a modern metropolitan community situated in the Pacific coast. Its climate is hot and humid, but rainfall is almost unknown, and regional agriculture is wholly dependent upon irrigation based on rivers flowing from the mountains to the sea. Sera were collected in government-run free clinics from people of low socio-economic status who live under very crowded and unsanitary conditions. They are primarily *mestizo* — of mixed Spanish and Indian blood. Specimens were also collected from an upper economic population group living under environmental conditions comparable to the best in any large city in the United States. A third group was sampled in the Province of Chancay, a rural area not far from and north of Lima. This *mestizo* population also lives under unsatisfactory conditions and with considerable household crowding, but in small farming communities. The fourth group of specimens came from individuals living in Arequipa and environs. This southern Peruvian city lies at an altitude of 8,000 feet in a large irrigated valley. The climate is cool and comfortable, with little rainfall. The population sampled was a lower socio-economic group containing both *mestizos* and pure Indians. The fifth group was combined from two separate areas, the Departments of Puno and Cuzco. These lie at altitudes of 12,000 and 10,000 feet respectively in the cold Altiplano which has distinct rainy and dry seasons. The people sampled are pure Indians, living both in small communities and in widely separated adobe compounds and under very primitive and unsanitary conditions.

Colombia : Only the city of Cali was included. The population sampled was a lower socio-economic group living under crowded urban conditions, and closely comparable with the similar group in Lima.

Collection and handling of blood specimens

Specimens were sterilely collected in vacuum bleeding tubes. The majority were sent intact by air cargo to the laboratory at New Orleans where the sera were separated. Although a week or more had often elapsed between the day of collection and the day of separation, no serious hemolysis had occurred, and no difficulty attributable to handling was encountered in testing. Some separated sera were sent to New Orleans in sterile screw-capped vials.

Examination of sera

Sera were examined for the presence of neutralizing antibodies to each of the 3 poliovirus types by either of two tissue culture techniques. In either case the test strains of virus were those in use in this laboratory for several years (Fox et al., 1957). Monkey kidney cells, prepared by a method modified from that of Melnick (1955) were used throughout. Sera were tested in final dilution of 1 in 4 with a few exceptions where it was insufficient in quantity and a dilution of 1 in 10 was used. The majority were tested by direct microscopic examination in the cythopathic test following incubation of the serum-virus mixture at room temperature for 30 minutes (Fox et al., 1957). A small proportion of the sera were tested by the metabolic inhibition technique (Melnick and Opton, 1956). Results from the two methods were very comparable.

Results

Tables I to VI present the results of serological tests for neutralizing antibody in the sera of the various population groups sampled. The results by individual virus type indicate the presence of all types and their generally parallel age pattern of occurrence. Type 3 shows some lag in occurrence in the first few years of life in Lima, Chancay and Cali, suggesting that it has been less frequently present during the past few years in these localities. In older age-groups percentages are about the same for all types.

Mean percentage of sero-immunity has been calculated by averaging the percentages for each of the individual types within each age-group. This mean gives an indication of the total impact of poliovirus infection on a community, tending to minimize temporary variations between the types, and permits ready comparison between different localities. In Fig. 1 the age-patterns for the equivalent lower socio-economic groups have been plotted, and the marked parallelism between the areas is readily seen. Only the dispersed

Table I. Lima, Peru. Sero-immunity to polioviruses in a lower socio-economic urban population, as indicated by neutralization test.

Age (Years)	Number of sera	Percentages of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
less than 1	26	23	0	0	8	0	77
1	23	30	26	26	27	4	39
2	16	75	69	37	60	31	13
3	14	64	79	71	71	71	21
4	13	100	92	92	95	77	0
5 - 6	59	93	97	90	93	83	0
7 - 9	21	76	91	86	84	67	0
10 - 19	48	100	87	90	92	81	0
20 +	25	96	88	88	91	76	0

* Mean of the percentages for each type considered separately.

rural population of Puno-Cuzco lags behind during the pre-school years of childhood. Except in the latter area, children have attained 75 to 80 per cent. sero-immunity by the age of 3 years, and in all areas they reach a stable level of over 90 per cent. by 7 to 9 years.

TABLE II Lima, Peru Sero-immunity to polioviruses in an upper socio-economic urban population, as indicated by neutralization test.

Age (Years)	Number of sera	Percentage of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
less than 1	2	*1*[†]	*1*	*1*	*1*	*1*	*1*
1	3	*2*	*0*	*2*	*1*	*0*	*0*
2	5	*4*	*2*	*3*	*3*	*1*	*1*
3	14	43	50	50	48	0	0
4	9	56	56	56	56	11	0
5 - 6	15	60	60	73	64	40	0
7 - 9	23	96	65	61	74	44	0
10 - 19	44	96	84	89	90	73	0
20 +	1	*1*	*1*	*1*	*1*	*1*	0

* As in Table I.

[†] Numbers in italics represent the actual numbers of sera found positive rather than the percentage positive, and are used because the specimens were too few on which to base calculated percentages.

TABLE III Provincia de Chancay, Peru Sero-immunity to polioviruses in a lower socio-economic rural population, as indicated by neutralization test

Age (Years)	Number of sera	Percentage of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
less than 1	11	27	9	0	12	0	73
1	40	43	20	20	28	5	40
2	15	67	67	80	71	40	0
3	14	93	63	86	81	57	0
4	14	100	71	71	81	57	0
5 - 6	17	88	82	88	86	77	0
7 - 9	28	100	97	86	94	82	0
10 - 19	76	97	96	92	95	86	0
20 +	13	100	85	85	90	77	0

* As in Table I.

These patterns are quite similar to those found in other poorly sanitated populations in Africa and southern Louisiana (GELFAND and MILLER, 1956).

Use of the mean percentage of sero-immunity also makes possible a ready comparison between different population groups in the same locality. The lower socio-economic group (Fig. 2) shows a more rapid accumulation of poliovirus antibodies than the upper

TABLE IV. Arequipa, Peru. Sero-immunity to polioviruses in a lower socio-economic mixed urban-rural population, as indicated by neutralization test.

Age (Years)	Number of sera	Percentages of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
less than 1	28	7	14	11	11	4	79
1	59	17	36	21	25	2	46
2	32	41	56	47	48	19	25
3	31	90	84	64	79	55	3
4	24	92	88	79	86	63	0
5 - 6	26	100	92	96	96	89	0
7 - 9	9	100	89	100	96	89	0
10 - 19	26	100	89	100	96	89	0
20 +	14	100	93	64	86	64	0

* As in Table I.

TABLE V. Departments Puno-Cuzco, Peru. Sero-immunity to polioviruses in lower socio-economic rural populations, as indicated by neutralization test.

Age (Years)	Number of sera	Percentages of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
1	20	20	45	15	27	10	45
2	21	19	33	33	28	5	38
3	43	65	56	46	56	21	9
4	27	74	44	74	64	30	7
5 - 6	20	100	55	70	75	40	0
7 - 9	36	97	89	95	94	81	0
10 - 19	63	94	89	97	93	80	0
20+	31	97	91	94	94	80	0

* As in Table I.

group, although both reach the same level of about 90 per cent. by 10 to 19 years of age.

Tables I to VI also show the percentages of each age-group with antibodies to all 3 poliovirus types and to no type. This is plotted in Fig. 3 to show the accumulation of total immunity in the lower socio-economic population as a whole in the areas studied,

TABLE VI. Cali, Colombia. Sero-immunity to polioviruses in a lower socio-economic urban population, as indicated by neutralization test

Age (Years)	Number of sera	Percentages of sera with neutralizing antibody					
		Type 1	Type 2	Type 3	Mean*	All types present	No type present
1	31	35	23	35	31	3	29
2	23	57	87	48	64	30	9
3	20	90	90	45	75	30	0
4	27	89	96	74	86	63	0
5 - 6	32	91	84	88	88	72	0
7 - 9	75	99	96	91	95	88	0
10 - 19	89	95	98	91	95	88	0
20+	10	90	100	90	93	80	0

* As in Table I.

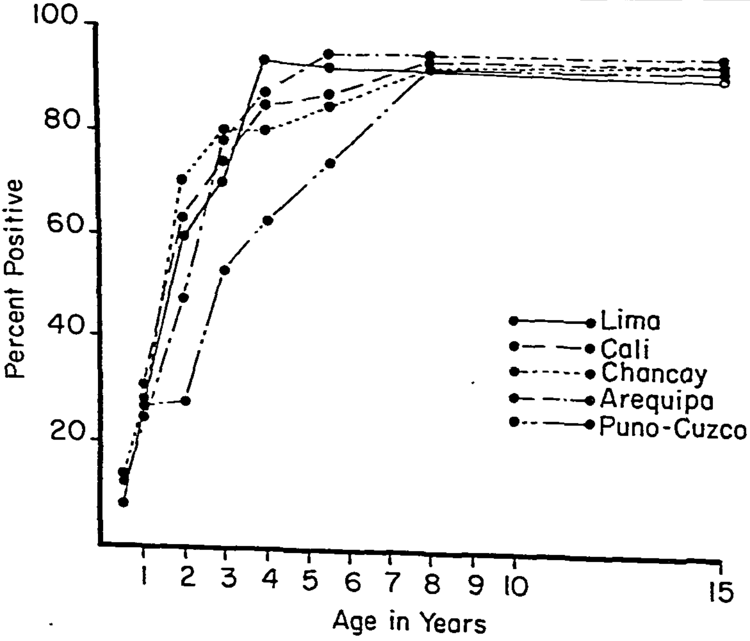


FIG. 1. Comparative sero-immunity to polioviruses (mean of all types considered separately) in lower socio-economic population groups in Cali, Colombia and Lima, Chancay Province, Arequipa, and Puno-Cuzco, Peru.

as well as the rapid decline in immunologic " virgins." Within 7 to 9 years, 80 per cent. of all the people tested have become triply immune ; by 5 to 6 years, none remain who do not have immunity to at least one type. The socio-economic contrast is plotted again on the basis of total immunity in Fig. 2, and is similar to that shown by mean percentages.

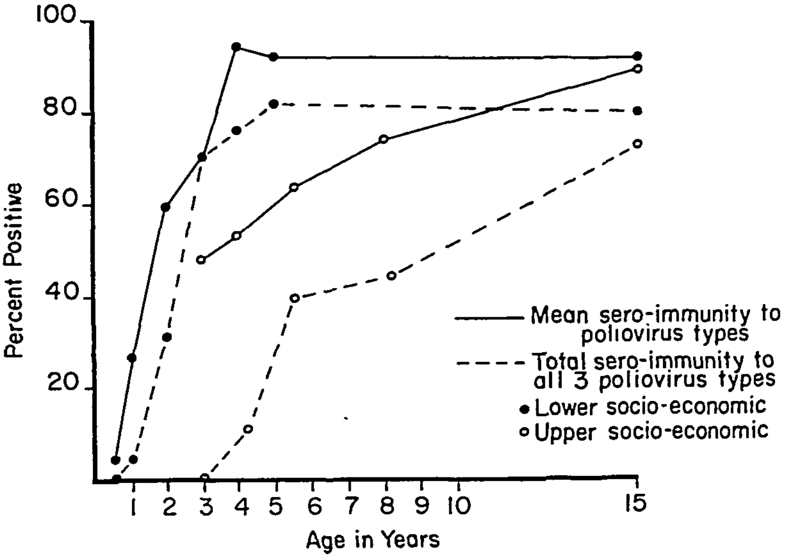
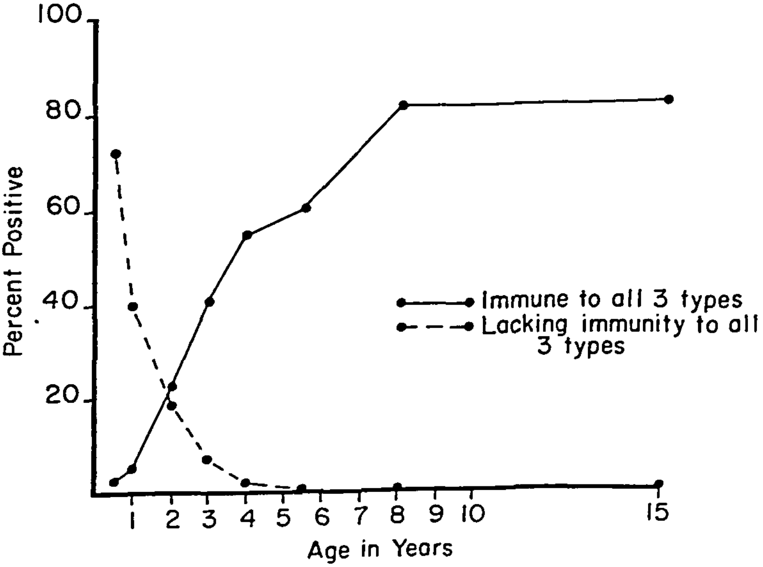


FIG. 2. Comparative sero-immunity to poliovirus in populations of different socio-economic status in Lima, Peru, as indicated by mean sero-immunity to poliovirus types and by total sero-immunity to all 3 virus types.

FIG. 3. Percentages of all lower socio-economic population groups studied in Peru and Colombia with sero-immunity to all 3 poliovirus types and lacking immunity to all 3 types.



DISCUSSION

The results presented above indicate a population heavily saturated with poliovirus, in which infections are frequent and occur early in life. This finding is entirely compatible with the infrequence of overt paralytic poliomyelitis, and its restriction to young children when it does occur. The results also suggest a slower rate of infection in the upper socio-economic group in Lima as compared with the poorer classes. We should expect this phenomenon to hold also in Cali, and if so, it would be completely compatible with the relatively more frequent occurrence of paralytic disease in the well-to-to classes which was noted during the 1956 epidemic in that city.

The changing age pattern of occurrence of " infantile paralysis " in western Europe and the United States has been well documented. Poliomyelitis is known to have existed in ancient Egypt, and occasional cases have undoubtedly occurred ever since. Although clearly recognized since the 18th century, the first outbreak of any size was noted only as recently as 1887, in Stockholm, Sweden (PAUL, 1954). Since that time, however, epidemics have occurred with great frequency in western Europe and North America. It is remarkable, however, that total morbidity may not have greatly increased, after the epidemic pattern was established (SABIN, 1949), although exactly comparable data are difficult to accumulate because of improved reporting, the increase in reporting of non-paralytic cases, and the increasing population. Total mortality may actually have declined, undoubtedly as the result of the improved treatment of bulbar cases.

A second phenomenon emerged after the epidemic pattern of occurrence had become typical, i.e., a shift in the age distribution of paralytic cases to older children and adults. This has been extensively reviewed by SABIN (1949) and FREYCHE and NIELSEN (1955), who show that it has occurred wherever poliomyelitis has long been present. Initially a disease of very young children, the percentage distribution of cases has changed until the age group 5 to 9 years, or even older, has become the most affected. Examined more simply by comparing the percentage of cases younger and older than 15 years, Copenhagen, Denmark, which had a ratio of 80 - 20 per cent. in 1934, showed a change to 47 - 53 per cent. in 1944. Other cities, starting with lower adult attack rates, show the same inevitable tendency.

The three phases in the evolution of poliomyelitis as a disease, viz., sporadic cases, epidemics of " infantile paralysis," and epidemics affecting progressively older children and adults, seem reasonably explainable by the interplay of four generally accepted phenomena. (1) Long lasting immunity results from homologous natural infection (MELNICK and WALTON, 1955). (2) Transmission of the virus is by way of fecal contamination, and transmission can be interrupted by improvement in personal hygiene and environmental sanitation (PAUL, 1955). (3) Within any given poliovirus type, strains of greatly varying virulence exist in nature (SABIN, 1951). (4) The age at which infection occurs affects the likelihood of paralytic disease, young children being most resistent to the consequences of infection (BURNET, 1953).

Based on these 4 premises, we can visualize the changes which occur in the biology of poliomyelitis in the following way. Under primitive conditions of sanitation, polioviruses saturate the community to such an extent that children become infected very early in life, most often with the naturally-occurring avirulent strains. An occasional as well as the rapid decline in immunologic "virgins." Within 7 to 9 years, 80 per cent. of all the people tested have become triply immune: by 5 to 6 years, none remain who do not have immunity to at least one type. The socio-economic contrast is plotted again on the basis of total immunity in Fig. 2, and is similar to that shown by mean percentages.

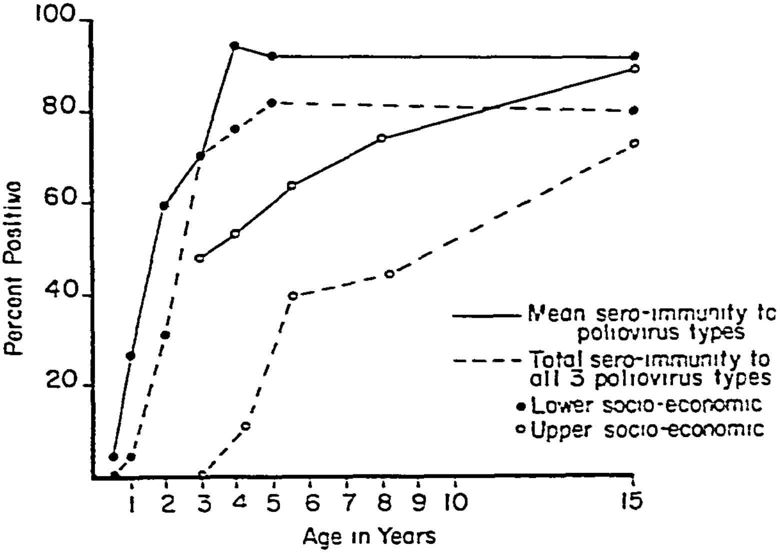


FIG. 2. Comparative sero-immunity to poliovirus in populations of different socio-economic status in Lima, Peru, as indicated by mean sero-immunity to poliovirus types and by total sero-immunity to all 3 virus types.

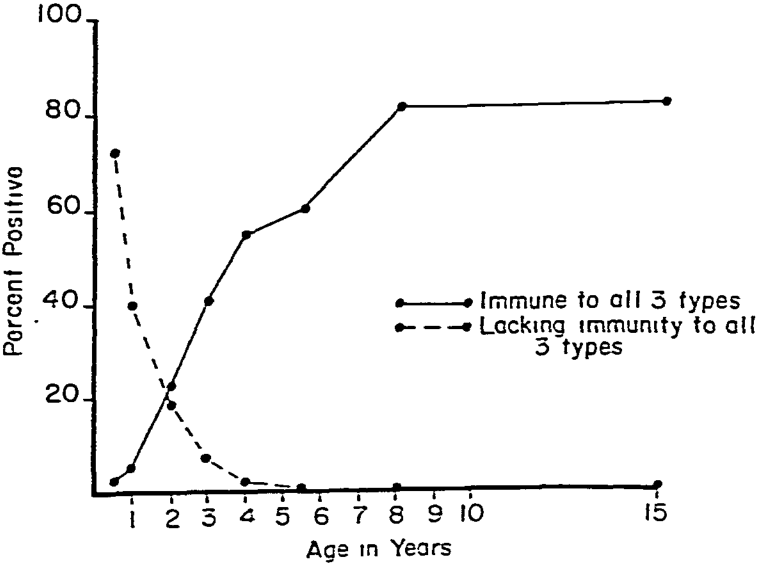


FIG. 3. Percentages of all lower socio-economic population groups studied in Peru and Colombia with sero-immunity to all 3 poliovirus types and lacking immunity to all 3 types.

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BOOK REVIEWS

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Because of the limited number of pages, it was unavoidable that some of the material is somewhat condensed. The laboratory techniques are usually mentioned only in short notes. One of the most important fields for the pediatrician who works in tropical areas, is that of malnutrition and he will follow the 19 pages of this book dealing with this subject with particular interest. In spite of the well presented facts the pediatrician will feel unable to work without an additional, more detailed book — for example, the amount of space allotted to kwashiorkor and ascariasis in tropical children are very small.

As a summary it can be said the "Lehrbuch" is an excellent introduction into the field of tropical medicine and presents all the basic knowledge of this field.

W.H.

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This booklet is extremely valuable to the tropical pediatrician, as, while all the sections, such as those on recent concepts concerning basic hepatic histology and physiology, are of interest, there are, in addition, several contributions which are first-class reviews of topics of immediate practical importance. Outstanding amongst these is the chapter by Waterlow and Bras on "Nutritional Liver Damage in Man," which contains a concise, authoritative account of such predominantly paediatric problems as liver atrophy, fatty infiltration, various forms of juvenile cirrhosis and "malarial" cirrhosis, and carcinoma of the liver.

All in all this is a particularly good publication in what has come to be regarded as a most valuable series. Other sections of especial relevance to the tropical pediatrician are those by Sutton on radiology, including the splenic venogram, by Cullinan on the course and prognosis of infective hepatitis, and by Sherlock on liver failure and by Stokes and Rosenheim on the treatment of diffuse liver disease.

individual becomes paralyzed because of unusual susceptibility. As sanitary standards begin to improve, infection is delayed to an extent that permits the accumulation of large numbers of young non-immunes. Waves of infection with avirulent strains still occur unnoticed, but occasionally a virulent strain is introduced, and an epidemic with an infantile pattern results. As economic and sanitary standards rise still further, there are two results ; infection is delayed until an even older age, and an increasing number of individuals miss infection throughout life. If a virulent strain is then introduced into the community older, non-immune individuals are infected and paralyzed, and the age distribution is shifted upward. However, personal hygiene and environmental sanitation now provide an effective block to the transmission of infection in addition to the partly reduced obstruction of pre-existing immunity. As a result an increase in the total number of cases may not accompany the changed age pattern.

Many of the countries of Central and South America, as well as other tropical areas, appear to have entered the second phase in the evolution of poliomyelitis, and can anticipate repeated epidemics, eventually involving older children and adults unless prophylactic vaccination changes the picture. Upper socio-economic groups are particularly at hazard. The recent (1956) epidemic in Chicago (BUNDESEN et al., 1957) is particularly illuminating. This severe outbreak started in a very poor, congested, non-white section of the city, remaining most severe there but spreading to other areas as well. The paralytic attack rates attained were considerably higher in the non-white population (84.4 per 100,000) and the median age was 3.4 years ; in the white population the paralytic rate was lower (9.5 per 100,000) but the median age was 8.3 years.

A word of caution is indicated, however, concerning mass vaccination campaigns against poliomyelitis. Despite the tragic toll taken by epidemics of this disease, in most tropical countries it is a small part of the public health problem. When compared to nutritional deficiency, diarrheal diseases, and other epidemic infectious diseases, it must be ranked low in order of priority for the personnel, time, and money required for preventive medical programmes. However, in carefully evaluated, selected situations, such as in certain cities or in certain social groups, its use may be well justified at the present time.

SUMMARY

The recent history of poliomyelitis in Central and South America was reviewed, and the results of neutralization tests for sero-immunity to poliomyelitis in 1,430 sera from healthy individuals from various localities in Peru and Colombia were then presented in detail. These tests showed that a high percentage of these people possess antibodies to all 3 poliovirus types, the acquisition of antibodies beginning very early in childhood (an average of 75 to 80 per cent. by 3 years of age) and increasing with age. This suggests that the population is heavily saturated with these agents and that subclinical infections occur with great frequency. The different results from upper and lower socio-economic groups in Lima were contrasted, and indicated a relative delay in infections in the former group. The evolution of poliomyelitis as an epidemic disease was discussed, and it was concluded that the countries of Central and South America are entering the second phase in that evolution, in which epidemics of " infantile " type occur. These countries can anticipate repeated epidemics, which will gradually change in character to those of the third phase with older segments of the population more frequently involved.

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TROPICAL ASCARIASIS*

by

C. C. de Silva†
(Professor of Paediatrics, University of Ceylon, Colombo)

Ascariasis in the tropics as a clinical and epidemiological problem is fundamentally different from ascariasis in the West. These variations are due to differences of socio-economic and cultural levels rather than to those of geography and climate.

Fig. 1 shows the death rates in the Colombo district between 1938-1954 resulting from (i) all helminths, except the ankylostome (in our country, ascariasis in over 90 per cent. of cases) and (ii) ankylostomiasis. While the latter has been reduced to one-sixth of the initial rate over a period of 17 years, the former has not even been halved.

Contrary to the experience of Stransky (1955) in the Philippines, we have found that *roundworm infection occurs nearly twice as often in children from the rural areas as* those from the city of Colombo.

There were three reasons which accounted for the severity of the symptoms in our patients. The first and the most important was their nutritional status. 75 per cent. of the patients who were under 4 years of age admitted to the Children's Hospital were suffering from undernutrition. *In the school-going population it has been found that nearly 1 in 4 of healthy children in Colombo were underweight.* Various recent surveys by different workers have confirmed the opinion that the diet of the population of Ceylon is deficient in calories, protein and other factors, and Venkatchalam and Patwardhan (1953) have shown that there is interference with nitrogen absorption from the gut even in moderate infestations with the ascaris.

Our studies on a group of 33 children with ascariasis revealed that in the majority of them there was only a slight or no increase of total plasma protein levels after deworming and in only 7 (21 per cent.) was there a significant rise. We realise the inadequacy of these studies as a base for definite conclusions, but this is a preliminary investigation which will be followed by further work.

---

* This paper was read at a plenary session of the 8th International Congress of Paediatrics at Copenhagen in July, 1956.

† My thanks are due to Mr Milroy Paul, Professor of Surgery, University of Ceylon and to Dr Norman Fernando, Surgical Registrar, Lady Ridgeway Hospital for Children, Colombo for permitting me to peruse the bed-head tickets of their patients and to use their material ; to Dr Gladys Jayawardena who performed the very tedious examination of laryngeal swabs, brains and lungs of patients , to Dr. Phillips who generously allowed me the use of his material on the treatment of ascariasis with piperazine citrate and adipate ; to Professor Sivalingam for helping me with the photography , to Messrs Almquist and Wiksell, Uppsala, Sweden for permission to republish figures 4 and 6 , to Drs Stella de Silva and Cyril Perera for aiding me with the text and to Drs. Patricia Fernando, Lalitha Jayawickrama and Benjamin David and the technical members of the Department of Paediatrics for assistance and help in many ways for which I am very grateful.

September, 1957, *The Journal of Tropical Pediatrics*

That ingestion of food by the parasite occurs directly from the host's intestine (Fig. 2) is now beyond any doubt. JELLIFFE (1953) has recently reviewed the literature pertaining to the effect of ascariasis on nutrition. There is ample evidence, as he points out, to suggest that there is ingestion of food by the parasite directly from the host.

Secondly, the severity of the clinical manifestations in our cases was due to the very heavy worm loads encountered. The passage of 100 - 200 parasites in children under four years of age was not an uncommon occurrence, while 600-1,000 have been seen occasionally by many observers.

Thirdly, the severe clinical picture was due to the frequent occurrence of multiple parasitism and the combined effect of the ankylostome, the whipworm and the ascaris. These multiple infections were very common in the poorer classes. GUNASEKERA (1953) showed that 68 per cent of village school children in Ceylon were infected with multiple intestinal parasites.

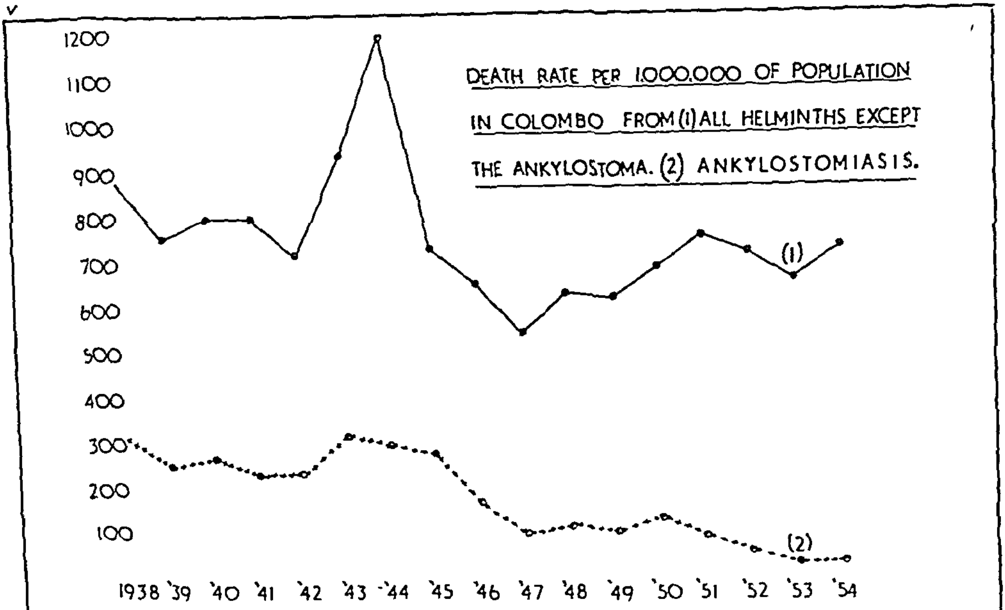


Fig. 1. Death rate per million population in Colombo district (1938 - 1954) from (i) all helminths except ankylostomiasis, (ii) ankylostomiasis.

Incidence of ascariasis in the hospital. At the Lady Ridgeway Hospital for Children in Colombo, of a total of just over 280,000 attendances in the out-patient department during 1955, over 55,000 were treated for ascariasis. These were mild cases which did not require indoor treatment. Ascariasis was the commonest of all diseases for which patients were admitted to our hospital. 1,967 of the total admissions in 1954 were cases presenting as such—12.8 per cent of these were fatal. In the following year, there were 1,899 admissions with a 6.8 per cent fatality rate. This significant fall in mortality has coincided with the introduction and general use of piperazine citrate.

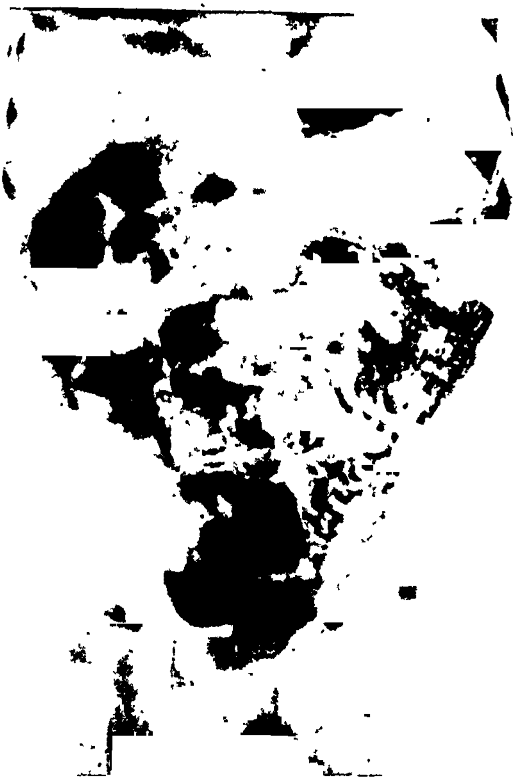


Fig. 2. X-ray of child's abdomen after barium meal, showing "railway lines" shadows believed to be produced by the barium inside the alimentary canals of the ascarids.

TABLE I. Incidence of intestinal helminths in children attending Lady Ridgeway Hospital for Children, Colombo. *Ascaris lumbricoides* is the commonest, and is twice as frequent as, the whipworm and over three times as common as *Necatar americanus*. Mixed infections are just below 50 per cent. of the total.

1950-1954—total cases examined.	5860	Percentage
Ascaris lumbricoides	2267	38.7
Trichuris trichiura	1200	20.5
Necator americanus	704	12.0
Giardia lamblia	123	2.1
Entamoeba histolytica	111	1.9
Ascaris — Total No. of cases	2267	
Ascaris only — No. of cases	1230	
Percentage of ascaris only to—total ascaris infections		54.3

General and age incidence of in-patients in hospital. The general incidence shows that the ascaris is the parasite most frequently encountered in children in our hospital and that nearly 50 per cent. of these patients also harbour other parasites (Table I). Ascariasis is very rare under 6 months, is uncommon under 1 year of age, is common between 1 - 6 years and becomes less so after that age (Table II and Fig. 3). This reduction

TABLE II. ✓Incidence of ascaris infection in different age-groups, showing main incidence falls between 1 - 6 years.

Age groups	No. of cases	Percentage to total
0 - 6 months	4	0.2
>6 months - 1 year	58	2.5
>1 year - 2 years	342	15.1
> 2 years - 3 years	432	19.1
> 3 years - 4 years	402	17.7
>4 years - 5 years	292	12.8
>5 years - 6 years	249	10.9
>6 years - 7 years	168	7.4
>7 years - 8 years	141	6.2
>8 years	179	7.9
Total	2267	

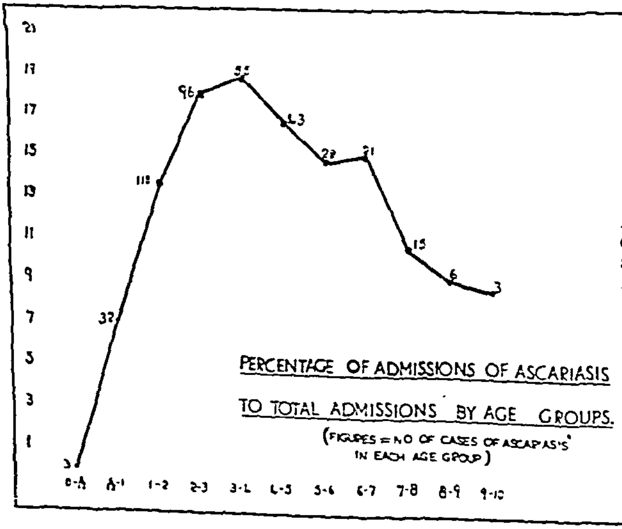


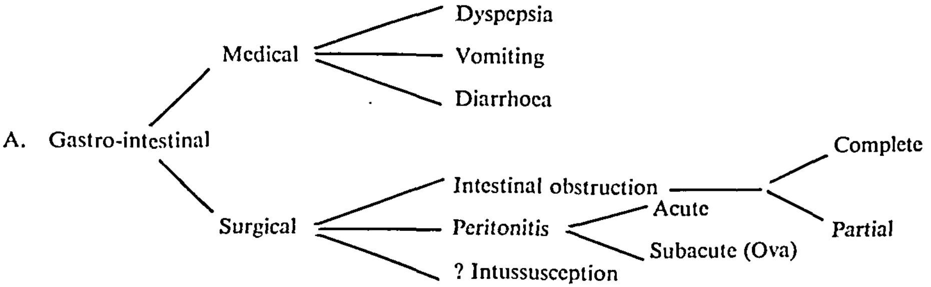
Fig. 3. Percentage admissions of children with ascariasis to total admissions at different age groups, showing that main point of infection falls between 1 - 7 years.

after 6 years is due, I believe, to less promiscuous defaecation, less intimate contact with the soil coinciding with the school-going age, and more self-consciousness on the part of the child, especially with relation to toilet habits.

CLINICAL SYNDROMES

I do not wish to waste time on the first group (Table III), which is probably very familiar to many of you and has been fully described by me in a previous publication (DE SILVA, 1954).

✓TABLE III. Classification of clinical syndromes of ascariasis.



B. Prolonged and pyrexial with hepatomegaly.

C. Toxaemic with nervous symptoms.

D. Pulmonary.

E. Atypical cases due to migration of larvae and adults to unusual sites.

F. Allergic.

(1) *Vomiting.*

This is an acute episode in a chronic illness, but is a trap and a snare for the unwary, especially when the vomiting contains roundworms. Vomiting in young children nearly always suggests the possibility of ascariasis to the practitioner in the tropics. However, 3 cases of acute appendicitis with perforation confirmed at autopsy had been missed because of this. Vomiting of these parasites may often be equivalent to rats leaving a sinking ship.

(2) *Surgical ascariasis.*

I am indebted to Professor PAUL and his registrar, Dr. NORMAN FERNANDO, for permitting me to refer to their cases of surgical ascariasis which are a more than weekly problem with us.

There were 73 cases admitted to the surgical unit in 1955 as cases of ascariasis with acute or subacute abdomens (Table IV.). Surgical ascariasis was often initiated by injudicious treatment with vermifuges, such as santonin and the piperazine compounds. It was likely to occur in children with very heavy infestations and it led most frequently to partial obstruction and less commonly to perforation of the intestine with peritonitis.

Table IV shows that over 50 cases gained admission due to partial intestinal obstruction. In over two-thirds of these, there was a palpable lump, which could often be mistaken for an intussusception. Rigidity was absent, abdominal distention was slight and diarrhoea was as frequent as constipation. Blood was not passed *per rectum* nor was it present on an examining finger. These cases did not need any surgical intervention, but, in the vast majority of instances, recovered with high saline enemata, liquid paraffin and tincture of belladonna by mouth.

(i) *Acute intestinal obstruction.* Complete blockage occurred in 10 cases with 2 deaths. In this series only one patient had an incision into the intestine with manual removal of the worms. In the other cases the parasites were " milked on " to the caecum without any incision into the gut and all except one recovered. Professor PAUL has now followed this technique in 12 cases with 2 deaths, while there have been 3 deaths out of 4 where an incision had been made into the gut with or without resection. It is an interesting fact that these obstructions have almost invariably occurred in the ileum and not in the jejunum which is the natural habitat of the round worm — so that migration must first take place before obstruction can occur. One case of volvulus due to the ascaris has recently been seen at operation.

✓ TABLE IV. Surgical ascariasis — analysis of 73 cases, aged between 10 months and 10 years.

		Operated		Not operated	
	Cases	Recovered	Deaths	Recovered	Deaths
Complete intestinal obstruction	10	8	1	0	1**
Partial intestinal obstruction	50‡	2	0	42	2*
Acute peritonitis	10	2†	5	0	3

Perforations : 1 in the jejunum. 4 in the ileum.
4 in the appendix. 1 in the ascending colon.

* 1 other case removed against advice.

** Condition too low for operation.

† In 1 case no perforation was seen. In the other a perforation at the tip of the appendix was discovered.

‡ In 3 cases the condition of the patient was too low for operation — no autopsies were allowed.

(ii) *Acute peritonitis.* 10 cases were admitted in 1955 with 8 deaths — 5 of these after operation. Clinically these patients had shown the usual signs and symptoms of acute peritonitis due to bacterial causes, except that rigidity was conspicuous by its absence. Peristaltic sounds were heard and the bowels had moved in the majority of cases. An acute appendicitis with a perforation either at the tip or at the base of the appendix, in the ileum or the jejunum was often encountered. In one case there were multiple perforations in the intestines, but in two, none could be discovered. In almost every case numerous round worms, both dead and alive, were found in the peritoneal cavity (Table IV).

(iii) *Subacute ascaris ova peritonitis.* As far as I am aware only 4 cases have been reported in the literature — one from the Philippines (AFRICA and GARCIA, 1936), two from the U.S.A. (JENKINS and BEACH, 1954 ; MOORE, 1954) and one from Ceylon (DE SILVA, 1954). At the operation by Professor PAUL on our patient, the appearance inside the peritoneal cavity was a replica of tuberculous peritonitis, but on histological examination of omental tissue, Professor COORAY reported that " the tissue was composed of a large number of eosinophil leucocytes, lymphocytes and macrophages. Amidst this cellular tissue are small circumscribed granulomata. A few of these show necrotic centres and resemble tubercles, but for the presence of some helminth ova which appear to be those of *Ascaris lumbricoides.*" (Fig. 4). This opinion was later confirmed by the parasitologists at the London School of Tropical Medicine and Hygiene.

I believe that one adult round-worm had escaped through a weak spot in the wall of the intestine of our patient, laid her eggs in the peritoneal cavity and died soon after.

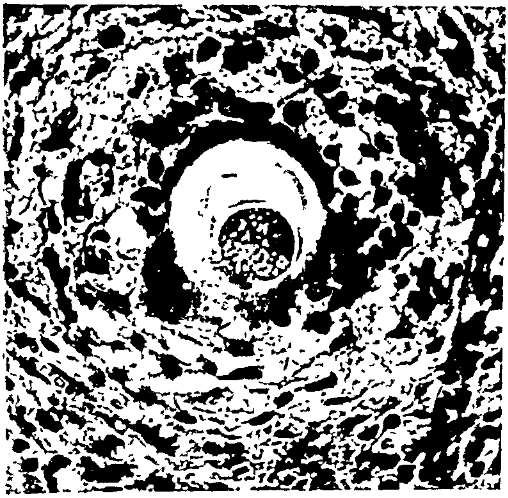


Fig. 4. Ascaris ovum engulfed by a giant cell, surrounded by fibroblastic reaction, from case of subacute ascaris ova peritonitis.

Experimental work, not yet published, by COORAY and PANABOKKE (1956) suggests that ascaris ova introduced into the peritoneal cavity of rats produced similar lesions to those that I have shown here and that the eggs do not develop any further. This patient has made me wonder how many of the cases of so-called tuberculous peritonitis in the tropics are in fact due to ascaris ova. This condition is probably commoner than a perusal of the literature would lead one to believe.

PAUL, who has had several years' experience of pediatric surgery in Ceylon, has encountered only an occasional case of intussusception caused by the roundworm, and he believes that this is an excessively rare sequence of events.

(iv). *Continued fever with hepatomegaly.* This was an uncommon syndrome in which the patient usually presented with high fever and delirium or drowsiness. The temperature, which was of the remittent type, continued for as long as 40 to 90 days. The abdomen was not conspicuously distended but was tender. Vomiting, diarrhoea and a grossly enlarged and tender liver were frequently present. The passage of 1 or 2 roundworms was almost a daily occurrence throughout the illness. The child recovered eventually, after having passed 100 - 200 roundworms or more over a period of 1 - 3 months and the liver returned to normal size.

These cases were due to massive infestation with the ascaris and the symptoms were caused, I believe, by larval involvement of the liver, lung and possibly other tissues. There was no high grade eosinophilia. This syndrome bore a clinical resemblance to that described in U.S.A. by BEAVER and others (1952) as "visceral larva migrans" and caused by the *Toxocara canis*. They have proved conclusively, in those cases in which the parasite was identified, that the *Toxocara* and not the *Ascaris lumbricoides* was the cause of the symptoms in their patients, who had a high grade eosinophilia and hyperglobulinaemia, and who did not respond to any treatment, but made spontaneous recoveries. On the other hand, in our patients there was no high grade eosinophilia, but the passage of numerous ascarids and a response, though tardy, to anti-roundworm treatment. Some of our cases of tropical eosinophilia, which are not associated with ascariasis, may be due to infection with *Toxocara canis* and certainly merit further investigation.

(v) *Toxaemia with nervous symptoms.* This syndrome was frequently encountered, and was commonest between the ages of 2 - 4 years. It bore no relationship to the nutrition of the host or the number of worms present. The commonest presenting symptom was fever with vomiting with or without roundworms. Irritability, restlessness and drowsiness were early changes, but convulsions also occurred infrequently. Occasionally there were grimacing or champing movements of the lips and mouth, together with a throwing about of the limbs, and delirium. When major convulsions were not present, twitching of the face and limbs often were. Meningismus was sometimes present ; the temperature sometimes was as high as 105°F. The death rate in 30 cases was 45 per cent. and in only one-quarter of these could this be attributed to dehydration. The cause of the toxaemia is still a matter of controversy. These nervous manifestations suggest a functional disturbance of the higher centres of the central nervous system. How is this caused ? It is not due to metabolites such as n-valeric, acetic, formic, tiglic, and other acids which have been found in the worm's tissues — most of these are normally present in the host. Is it due to larval invasion of the brain ? Larvae of the *Ascaris lumbricoides* have been reported in the human brain in two cases of poliomyelitis, but recently there has been some question whether these were not larvae of *Toxocara canis*. Dr. GLADYS JAYAWARDENA has investigated this problem by careful dissection in 11 brains of patients dying from roundworm toxaemia with completely negative results. BEAVER and his co-workers (1952) and SPRENT (1955) have recovered the larvae of *T. canis*, but not of *Ascaris lumbricoides*, from the brains of mice, rats etc. in experimental infections, although no signs or symptoms had been seen in their animals. SPRENT is of opinion that the nervous symptoms are caused by anaphylaxis rather than by the presence of any toxins. We believe that toxaemia of roundworms is due to an allergic reaction of the antigen — antibody type in hypersensitive nervous tissue. It occurs in a small proportion of cases, its sudden onset and its absence in many massive infestations and its presence in patients with very few ascarids suggest an allergic phenomenon.

(vi) *Pulmonary ascariasis.* This might manifest itself in the shape of bronchitis or bronchopneumonia. I have not found it possible in any individual patient to make a definite helminthic diagnosis. JAYAWARDENA has examined 36 swabs of the larynx from our patients with negative results. Sometimes haemoptyses, without radiological signs of any disease have been encountered, for which no other etiology but ascariasis could be suggested. In a few autopsies with massive infestations, haemorrhages of varying size from ½ - 1" in diameter and scattered throughout the surface and substance of a bronchopneumonic lung have been seen. Of 14 lungs examined by JAYAWARDENA only one showed the presence of larvae (Fig. 5). These were diagnosed as the larvae of *A. lumbricoides*, as their length ranged from 290 to 450 μ.

(vii) *Atypical cases due to migration of larvae or adults to unusual sites.* Larvae and adults have been described in nearly every organ of the human body. I have had two cases of this type published previously (DE SILVA, 1954). One of these was of multiple liver abscesses, with adult roundworms inside them, in a child who died of pulmonary tuberculosis with severe vomiting (Fig. 6) ; the other was in a child with severe jaundice, haematemesis and fever, when the autopsy revealed three holes at the lower end of the oesophagus and 22 roundworms in the thoracic cavity. Similar cases have been reported by other writers. There have been a few cases in adults of migration into the bile duct, which have been found at operation in Ceylon. We have not had a single case of migration into the pancreatic duct.

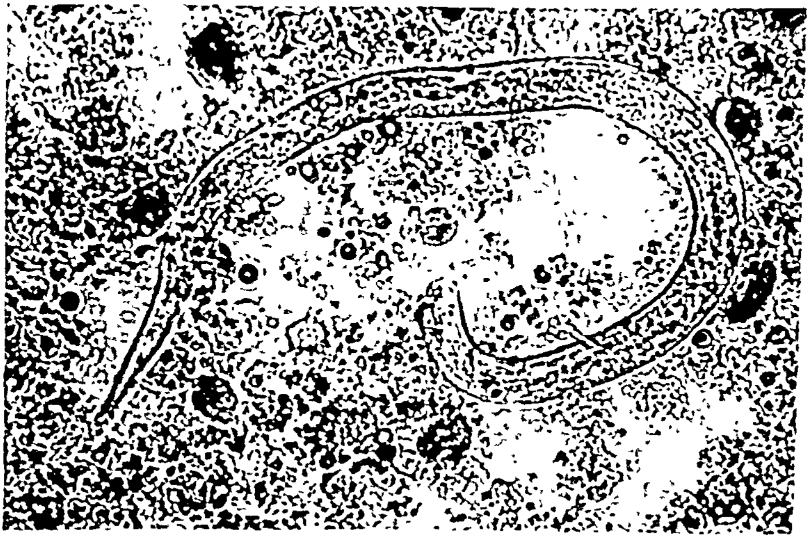


Fig. 5. Larva of *A. lumbricoides* from lung removed at autopsy (x 400).

PAUL and GUNAWARDENA have reported a case of an escape of roundworms through a Meckel's diverticulum and recently the former had a case where a child was operated on for peritonitis associated with 5 ascarids in the peritoneal cavity. Three weeks later a roundworm was observed emerging through the incision in the abdominal wall.

FERNANDO (1956) has seen a child in Colombo who presented with a cyst of the abdominal wall one year after an operation for intestinal obstruction due to roundworms. On incision into the cyst, 2 live adult worms were found.

(viii) *Allergic manifestations.* Very occasionally have I seen a case of acute spasmodic asthma due to ascariasis ; while urticaria and angio-neurotic oedema due to the handling of the roundworms have been met with in Ceylon in laboratory workers. Urticaria has also been seen occasionally in our patients.

TREATMENT

Within the last 5 years the treatment of ascariasis has changed. Prior to 1951, santonin, oleum chenopodium and hexylresorcinol were the drugs most widely used—only the last of these is now employed by us in some mixed infestations. Until 2 years ago the carbamyl-piperazine compounds ("Hetrazan," "Banocide") were used very frequently, but we have now changed over completely to piperazine citrate and adipate. Table V shows the results obtained by Dr. **Phillips**, Registrar of the Children's Hospital, Colombo. Of 63 cases treated with piperazine adipate for one day, 62 per cent. were cured after 1 course, while the total cures after the second and third courses were 94 per cent. and 100 per cent. Of 33 children treated with piperazine citrate, the corresponding results were 42 per cent, 78 per cent. and 90 per cent. respectively—that is, there were approximately 10 per cent. of failures. These figures suggest a slight superiority in the results obtained with the adipate as compared with the citrate salt of piperazine. In all treatment schedules, purgation and starvation were not employed. If the bowels did not move, liquid paraffin was given. Three negative stools were accepted as criteria of cure.

Fig. 6 Multiple liver abscesses—an adult roundworm is seen curled up at the lower left-hand corner of the liver, two other abscesses are at the top and bottom right-hand corners of the figure. In all, 8 abscesses each containing an adult ascaris

In 1955 piperazine citrate was first widely used for our in-patients and our deaths due to ascariasis were immediately halved as compared with 1954. We cannot draw any definite conclusions as 3 years have not yet passed, but the evidence is highly suggestive that this drug may be given the credit for this fall in the death rate. Recently as a result

TABLE V. Results of treatment of ascariasis with different schedules of piperazine adipate and citrate.

Total dosage	No. of days	Doses per day	No. of cases treated	Cures (percentages)			Failures (percentages) (after 3rd course)
				After 1st course	After 2nd course	After 3rd course	
(i) *Piperazine adipate*							
(1) 0.75 gm/year (maximum 4.6 gm.)	1	2	28	43	43	15	0
(2) 0.1 gm/lb. (maximum 4.5 gm.)	1	2	35	77	23	—	0
Total :			63	62	32	6	0
(ii) *Piperazine Citrate* (1) 2 gm. (14 ml.) to 3 gm. (21 ml.)	1	1	19	37	37	16	0
(2) 0.1 gm./lb. (maximum 3 gm.)	1	1	14	50	36	7	7
Total (one dose courses) :			33	42	36	12	10
(3) 3 gm./day if over 30 lb. 2 gm./day if between 25-30 lb. 1.5 gm./day if between 20-25 lbs.) 1 gm/day if under 20 lbs.	3	1	27	89	—	—	11 (After one 3-day course)

of reading STRANSKY's excellent paper on ascariasis in the Philippines, I have tried a papain derivative (" Nematolyt ") in 10 cases. 5 of the patients had negative stool reports on the 8th day after treatment, 2 more showed over a 90 per cent. reduction in the ova count and 1 more over 80 per cent. In 2 cases the treatment was a failure. No firm conclusions can be drawn on these few cases but the results seem to be as successful as after treatment with piperazine citrate.

The recent use of intragastic oxygen in Russia (TALYZIN, 1954), India (VORA, 1955) and elsewhere has interested us, but I have no experience of its use. According to these reports it is cheap and effective, and the ova after treatment cannot develop any further, a very significant finding for the prophylaxis of the disease in heavily infested countries. Prevention of infection cannot be successful until our socio-economic standards rise much higher or a cheap and effective ovicide is discovered which may be safely and cheaply sprayed on the compounds and the floors of our houses by the Public Health Authorities.

SUMMARY

Ascariasis in the tropics is a vast epidemiological problem because of its wide and almost universal distribution. Clinically, due to under- and malnutrition, massive infestation and multiple parasitism the signs and symptoms are varied and often are of serious significance.

The clinical syndromes are classified under (1) gastro-intestinal which may exhibit medical or surgical problems. Partial intestinal obstruction, which may exhibit medical or surgical problems. Partial

intestinal obstruction, which is often mistaken for an intussusception clinically, is the commonest type of surgical ascariasis encountered — others are acute peritonitis and complete intestinal obstruction Subacute ascaris ova peritonitis is another interesting disorder often mistaken for, and treated as, tuberculous peritonitis ; diagnosis can only be made by histological examination of omental and other intraperitoneal tissue (2) continued fever with hepatomegaly is a rare manifestation, clinically akin to Visceral Larva Migrans caused by larvae of the dog roundworm (*Toxocara canis*) (3) toxaemia with nervous symptoms — this is considered to be an allergic phenomenon, though no one has yet conclusively proved that ascariasis is the cause (4) pulmonary ascariasis — a haemorrhagic type of pneumonia has been encountered at post-mortem A larva, presumably *Ascaris lumbricoides*, has been recovered from the lung in one case at autopsy. (5) atypical cases due to migration or larvae or adults to unusual sites (6) allergic manifestations

The results of treatment with modern piperazine compounds have been found to be superior to those which used to be obtained with santonin and the carbamyl-piperazine drugs Piperazine adipate has been shown to be slightly superior to piperazine citrate A papaine derivative has been used in a few cases and has shown results comparable to those resulting from piperazine citrate but the cases have been too few to draw firm conclusions

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EXCERPT

INTRACELLULAR COMPOSITION IN SEVERE CHRONIC MALNUTRITION

(S Frenk et al 1957 *Pediatrics*, 20, 105)

Data obtained in a study of the chemical composition of the tissues in malnourished Mexican preschool children are reported In most cases, muscle and skin showed an increase in total content of water, sodium and chloride The content of potassium in muscle was slightly to moderately decreased, particularly in clinically oedematous children Muscle obtained shortly before death frequently showed a marked shift of water and sodium into the intracellular compartment

THE EFFECT OF AUREOMYCIN ON UNDERNOURISHED AFRICAN CHILDREN

by

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INTRODUCTION

Growth rate and control of infection. The use of antibiotics as a supplement in the feeding of young animals has been the subject of much research in recent years and has proved a valuable means of increasing the growth rate, preventing mortality and reducing the incidence of infection (MARTIN, 1942 ; MOORE et al., 1946 ; HARNED et al., 1948 ; KNOEBEL and BLACK, 1952 ; BLACK and BRATZLER, 1952 ; JUKES et al., 1950 ; STOKSTAD and JUKES, 1950).

Owing to the more rapid growth of experimental animals, their response to antibiotics has been easier to assess than that of human beings, and, so far, few trials have been undertaken in the latter, and only one in grossly undernourished children in whom the maximum response might be expected (LEWIS et al., 1956).

A clinical trial by ROBINSON (1952) with premature infants showed that there was an increase in the rate of growth and a reduction in mortality from infection when aureomycin, in small doses, was given daily, but a similar response was not obtained by COODIN (1953) using terramycin. In the supplementation of school diets with terramycin, streptomycin and penicillin, WETZEL and HOPWOOD (1954) found an improved rate of growth among the children treated and also that subclinical infections had less growth inhibitory effect in the antibiotic supplemented group.

Multiple trials in school children by SCRIMSHAW et al. (1954) with aureomycin and penicillin showed widely varying weight gains over periods of 2 - 3 years, irrespective of treatment. There was, however, an initial increase in height, and sometimes weight, among the aureomycin-treated groups during the first six months. A survey by CARTER (personal communication) among mentally defective, spastic children, showed that the prolonged administration of aureomycin produced a significant increase in the annual weight gain, and greatly reduced the incidence of gastrointestinal disorders. HAIGHT and PIERCE (1954) in a trial with young naval recruits found that antibiotics in small doses produced a significant weight increase in this age group also.

Drug Resistance. As a result of the widespread and often indiscriminate use of antibiotics in the treatment of human disease, the problem of drug resistant organisms and allergies has become increasingly common. It might be expected, therefore, that the prolonged administration of antibiotics associated with animal feeding experiments would eventually produce deleterious side effects, but so far this has not proved the case. The improved growth rate of treated animals has been maintained and disease epidemics largely eradicated, with the subsequent improvement in growth rate of unsupplemented animals in the same environment which has been attributed to the reduction in " disease potential " of their surroundings (LIBBY and SCHAIBLE, 1955).

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* I wish to express my thanks to the Director of Medical Services, Kenya Colony, for permission to publish this article, to Mr. Pearson of the Medical Research Laboratory, Nairobi, for the serological work, to Dr. O. B. Tandon of the Institute of Nutrition of Central America and Panama, for the statistical analysis of results, and to Lederle Laboratories, Pearl River, New York, for the supply of aureomycin and placebos.

It has been suggested by the work of SIZEMORE et al. (1955) that the beneficial alteration in intestinal flora brought about by prolonged antibiotic feeding may in fact be permanent, as it has been shown that the improved state of nutrition and growth in animals can continue even when the antibiotic is withdrawn.

With regard to clinical trials, it was noted by CARTER (personal communication) that infections occurring in children on minimal doses of aureomycin were rapidly controlled when the dose was increased to the usual therapeutic level.

Protein sparing effects : Conflicting results have been obtained by those investigating the protein sparing effects of antibiotics. It appears that the greatest effect is achieved with the supplementation of plant protein rather than animal protein diets (VIJAYARAGHAVAN et al., 1952 ; CARROL et al., 1953 ; BERRY and SCHUCK, 1954). Increased nitrogen utilization, has been demonstrated by some authors (CARROLL et al., 1953), but not by others (KNOEBEL and BLACK, 1952 ; BLACK and BRATZLER, 1952). BERRY and SCHUCK (1954) consider that antibiotics improve the digestibility of certain vegetable proteins without significantly increasing the nitrogen utilization. No similar metabolic studies have been reported in children, but the fact that a protein sparing effect has, in some instances been demonstrated in animals may be a point of possible future importance when designing the economic treatment of undernourished children in countries where protein intake is low, of poor quality and difficult to obtain.

Effect on serum proteins and blood constituents. From the work of SQUIBB et al. (1952, 1953) on hens and pigs, it was concluded that aureomycin had no apparent effect on the serum protein levels, haemoglobin, red blood cell count or haematocrit. Similarly, AGUIRRE and SCRIMSHAW (1955) found no significant effect on the haemoglobin, red blood cell count or haematrocrit of Central American school children after a two-year period of aureomycin administration.

SATOSKAR and LEWIS (1954) on the other hand demonstrated a highly significant rise in plasma albumin and fall in β and γ globulin when terramycin in doses of 50 mg. daily was given to Indian medical students.

A further study with undernourished children by LEWIS et al. (1956) showed that antibiotic-treated cases recovered more rapidly than the controls, there were no deaths and there was a greater rise in haemoglobin and serum albumin. Serum globulin levels either remained static or showed a fall, whereas the globulin levels of the controls continued to rise during dietary therapy.

PRESENT TRIAL

Existing Conditions. In African hospital practice in Nairobi, malnutrition presents a constant problem. On admission, many cases show a picture of severe emaciation and, in the majority, there is a preceding history of acute infection.

In such cases, diarrhoea of varying degree is common, oedema rare, and total serum protein levels within normal limits. Although many show skin and hair changes similar to those described in connection with kwashiorkor, the general clinical picture differs from the typical kwashiorkor cases seen in Kenya, and response to treatment is, on the whole, much less satisfactory.

Prior to undertaking the present trial with aureomycin, the treatment of these children consisted, briefly, of the following :

(1) Parenteral administration of electrolyte solutions, if diarrhoea was severe and the child dehyrated.

(2) Graduated feeding with UNICEF skimmed milk, starting with quarter or half strength mixtures and feeding 1 - 2 oz. 2 hourly until the child could tolerate full strength skimmed milk in larger amounts less frequently, and an average daily intake of 44 gm. of protein was reached.

(3) Gradual supplementation of the milk diet with mashed banana, oranges, maize gruel, soup, mashed potatoes, egg, minced meat and beans.

In many cases progress seemed to stop at the stage where the child was on full strength skimmed milk with or without banana. Any further additions to the diet were followed either by an exacerbation of the diarrhoea sufficient to merit further resort to parenteral therapy, or complete refusal on the part of the child to take semi-solid foods. As a result, the weight remained static for weeks or months, and the child succumbed readily to ward cross-infections.

In contrast to this picture, the type of kwashiorkor case seen in Nairobi usually responds readily to the initial skimmed milk regime, and within 5-10 days clinical oedema has disappeared, appetite has improved and there is little difficulty in establishing mixed feeding.

These marasmic children then present three major clinical problems : (i) the difficulty in establishing a suitable mixed diet ; (ii) the prolonged hospitalisation necessitated by failure to gain weight, and recurrent diarrhoea ; (iii) the high rate of cross-infection. In addition, in a hospital where demand for beds always exceeds supply and the emphasis is on a rapid turnover of patients, these cases present a grave administrative problem.

Therefore, with the knowledge that antibiotics had been found of value in increasing growth rates and eliminating infection in animals, it was thought justifiable to assess their use in undernourished children under these circumstances.

Design of trial. The trial was undertaken in the pediatric wards of King George VI Hospital, Nairobi, and cases selected for inclusion consisted of severely undernourished children with no clinical evidence of active infection, who, in the normal course of events would have been treated entirely by the dietary regime described above. As the majority of cases still had signs of an active infection on admission to the hospital, they were not included in the trial until this had subsided. They were then delegated alternately to the aureomycin group and the control. Those in the aureomycin group received 50 mgms. of the drug daily in the form of a flavoured troche ; a similar, but inert, troche acted as a placebo for the control group. All cases were under the case of the same nursing staff, so that the hospital routine, diet and general attention was similar for both groups. The staff was unaware of the composition of the troches.

The trial was originally designed to cover an eight week period, but owing to unforeseen incidents, such as transfer of children to the infectious diseases hospital, or unauthorized removal by parents before completion of treatment, the trial period varied from 2 - 7 weeks, with an average of 37 days.

Before beginning treatment, either with the drug or placebo, the following facts were determined and assessments made : (1) Age, sex, tribe, and home environment ; (2) Weight ; (3) Full clinical examination, and assessment of general nutritional status according to the grades : Good, fair, poor, very poor, moribund ; (4) Total serum protein, albumin, globulin and albumin-globulin ratio ; (5) Haemoglobin and red blood cell count ; (6) Routine ward test of urine ; (7) Stool culture and examination for parasites ; (8) Mantoux test 1 : 1000. (Any positive reactors were excluded from the series).

During the course of the first 12-24 hours, an estimate was made of the child's appetite and psychological changes. Thereafter, the weight, general assessment of nutrition, psychological changes and appetite were made at weekly intervals. The serum proteins, haemoglobin and red blood cell count were determined again at the end of the trial, and subsequent examinations of urine and stools were made only in cases where the initial results had been abnormal or when clinical signs suggested the development of urinary or enteric infections.

RESULTS

The total number of children investigated was 72, in whom the average age was 2 years. Table I indicates the distribution by sex, tribe and home environment in the aureomycin group and the controls receiving the placebo.

The history of an acute infection immediately preceding the state of malnutrition was obtained in 83 per cent of the cases. As can be seen in Table II, measles, whooping-cough, respiratory and enteric infections, but particularly the latter, appeared to be the main predisposing factors.

Nutritional response and weight gain. Table III shows the response to treatment as assessed by weight gain and general clinical impression. Here it can be seen that the average daily weight gain of the children receiving aureomycin was 45.3 gm. as compared

TABLE I. Distribution by sex, tribe and home environment of aureomycin and placebo groups.

	Aureomycin	Placebo	Total
No. treated	38	34	72
Sex			
Male	20	22	42
Female	18	12	30
Tribe.			
Kikuyu	29	26	55
Jaluo	5	2	7
M'kamba	2	2	4
Muluhya	2	2	4
Other tribes	0	2	2
Home Enbironment.			
Rural	16	16	32
Urban	22	18	40

TABLE II. Type of acute infection *preceding* malnutrition.

Type of Infection	Aureomycin	Placebo	Total
Measles	0	2	2
Whooping-cough	1	3	4
Pneumonia	5	3	8
Enteric infections	12	11	23
Double infections :			
Respiratory and enteric or			
Measles, whooping-cough and enteric	6	7	13
Measles, whooping-cough and respiratory	8	2	10
Total	32	28	60

with 14.1 gm. in the controls — a difference which is highly significant. In the study of individual cases, it was noted that whereas only one child in the aureomycin group had an average daily gain of less than 20 gm., seven children in the control group actually lost weight during the trial period.

The general clinical assessment is in agreement with these findings — as can be seen by the fact that 17 children in the control group were still in the " poor-moribund " state at the end of the trial period and only 7 had reached a satisfactory level, whereas, 24 children in the aureomycin group were rated as " good " and there were none below the level of " fair."

TABLE III. Weight-gain and general nutritional status at end of trial period in aureomycin and placebo groups.

	Aureomycin		Placebo	
No. cases	38		34	
Average daily weight gain in gm. *	45.3		14.1	
S.D.	20.01		21.95	
Nutritional status	Before	After	Before	After
Good	0	24	0	7
Fair	0	14	0	10
Poor	5	0	2	8
Very poor	12	0	9	3
Moribund	21	0	23	6

* The data in this table are adjusted by multiple regression methods for differences in initial age and weight.

Appetite and psychological changes. KNOEBEL and BLACK (1952), and BLACK and BRATZLER (1952), have attributed the increased growth response in animals to an increased intake of food and lower incidence of feed refusal when on antibiotic supplementation. The findings in Table IV suggest a similar relationship in children, as it can be seen that a significantly high number of children in the aureomycin group showed an improvement in appetite within one week of starting treatment.

A high percentage of the children showed psychological changes ranging from complete apathy to varying degrees of irritability and temperamental instability. The response to treatment is also shown in Table IV, where again the aureomycin group appears to have a higher degree of improvement than the controls which probably coincides with their more rapid return to physical well-being.

Control of infection. With regard to the elimination of infection, aureomycin did not prove effective in completely eradicating ward cross-infections, but there was a lower incidence among the treated group than the controls, as can be seen in Table IV. It was also noted that whereas 71 per cent of the infected children in the control group showed a period of static weight or weight loss during the infection, only 53 per cent. of the treated group behaved similarly.

Although 24 children in the aureomycin group and 20 in the control group had clinical diarrhoea at the beginning of the trial, pathogenic organisms (*Shigella flexneri* and *Sh. sonnei*) were isolated from only two cases in each group. No specific additional treatment was given to the bacteriologically negative cases, and it was found that the average duration of diarrhoea in the aureomycin group was 2 weeks as compared with 4 weeks in the control.

No drug reactions, allergies or untoward side effects were noted in connection with aureomycin administration in minimal doses, and an increase in dosage to adequate therapeutic levels effectively controlled the majority of cross infections which developed in this group.

Serological and haematological response. Table V demonstrates the variation in total serum protein, albumin, globulin, albumin-globulin ratio, haemoglobin and red blood cell count before and after treatment in both groups. From these figures it has been estimated that although the average initial total serum protein was within normal limits in both groups, there was a significant rise in the aureomycin treated group $(p < 0.01)$, this rise being due to a significant increase in the albumin fraction $(p < 0.01)$. In the control group, there was no significant alteration in total serum proteins or serum albumin, but a significant increase in the globulin fraction $(p > 0.01)$. It was noted, however that the total serum protein and serum albumin levels were significantly lower in the aureomycin group than the controls before the start of treatment.

TABLE IV. Effect of aureomycin therapy on appetite, psychological status, etc.

Number of cases	Areomycin	Placebo
Total Number Cases	38	34
Poor appetite	19	16
Improved after 1 week	18	6
Psychological changes	37	31
Improved after 1 week	19	10
Normal at completion of trial	35	24
Developed intercurrent infection	19	28
Showed static weight or weight loss during infection	10	20

No improvement was obtained in the red blood cell count in either group, but there was a significant rise in haemoglobin in the aureomycin treated group $(p < 0.05)$.

CONCLUSIONS

From this preliminary investigation it has been concluded that small daily doses of aureomycin have a beneficial effect in improving the weight gain, appetite, physical and mental well-being, total serum protein, serum albumin and haemoglobin levels of severely undernourished children.

As a result, the length of stay in hospital is reduced, and the nursing problem eased by the more rapid return of normal appetite, and the ability of these children to feed themselves.

It is regretted that follow-up studies to assess subsequent progress on return to an inadequate home diet and environment were not undertaken, but it is hoped to continue the investigation, including this factor, and a subsequent report will be made.

TABLE V. Haemoglobin, red blood cell and plasma protein estimations in both groups.

	Before						After					
	Plasma proteins (gm./100 ml.)			A/G ratio	Hb. (gm./100 ml.)	R.B.C. (per cu. mm.)	Plasma proteins (gm./100 ml.)			A/G ratio	Hb. (gm/100 ml.)	R.B.C. (per cu. mm.)
	Total	Albumin	Globulin				Total	Albumin	Globulin			
(i) Aureomycin group												
No. of estimations	34	33	33	33	38	36	33	32	32	32	36	35
Mean values	6.69	3.65	3.03	1.24	10.90	3.73	7.73	4.54	3.19	1.43	11.72	3.98
Standard deviation	0.99	0.71	0.53	0.30	1.72	0.70	0.48	0.39	0.38	0.24	1.33	0.52
(ii) Control group												
No. of estimations	29	29	29	29	34	33	22	22	22	22	27	26
Mean values	6 93	4.09	2.84	1.48	10.80	3.78	7.35	4.12	3.28	1.29	10.41	3.71
Standard deviation	0.75	0.52	0.49	0.29	1.84	0.69	0.77	0.51	0.48	0.21	1.95	0 60

Although it is not anticipated that antibiotics will be used for the fortification of human diets to the extent that they have been used in animals, the results of this experiment indicate that aureomycin can prove a valuable adjunct to dietary therapy in clinical practice under the conditions described.

SUMMARY

A brief introduction concerning the growth-promoting and other effects of minimal daily dosage of aureomycin in animals and human beings is given, and the reasons for undertaking the present clinical trial outlined.

Seventy-two severely undernourished African children of average age 2 years were observed over a period of 2 - 7 weeks in order to assess the effect of small daily doses of aureomycin on growth, appetite, serum proteins, haemoglobin, red blood cell count and the control of intercurrent infections 38 of the children received 50 mg. of aureomycin daily, and a control group of 34 children received placebos. The dietary and nursing regimes were the same in both groups

The weight increases in the two groups showed a highly significant difference, those children on aureomycin having an average daily weight gain of 45 3 gm as compared with 14 1 gm. in the controls It was also found that aureomycin had the effect of improving general nutritional status, appetite and mental well-being as assessed by clinical observation

A significant increase in the total serum protein, serum albumin and haemoglobin levels was observed in the aureomycin group, but no significant change in the red blood cell count in either group. The significant rise in serum globulin which occurred in the control group was not noted in the aureomycin-treated group.

Ward cross infections were by no means eliminated, but there was a lower incidence among those receiving aureomycin, and fewer cases showed a period of static weight or weight loss during such infections. Aureomycin also appeared to cut short the duration of non-specific diarrhoea No drug reactions, allergies or other untoward side effects were noted as the result of aureomycin administration.

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MATERNAL AND CHILD HEALTH SERVICES IN S.E. ASIA (VI)· CEYLON

by

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The beginning of an organized health service in Ceylon can be traced to the year 1798, when, following a severe outbreak of small-pox, the British administration set up a number of civil medical establishments.

At present, the health department has three divisions : Medical, Public Health and Laboratory Services, each in the charge of a Deputy Director of Health. For purposes of health administration, the island is divided into 15 health districts, each under a superintendent of health services.

There is a medical officer at the directorate level, who is in charge of maternal and child health activities, among other responsibilities. Recently, it has been decided to establish a separate sub-division for maternal and child health. In addition, a separate children's department is also being created.

MORTALITY AND MORBIDITY

The statistical material available for Ceylon is more complete than is the case in other countries of the region. The birth rate was 34 per thousand in 1936, rose to a peak of 40.4 in 1943 and now, in 1955, is 37.9. The death rate has dropped gradually from 21.8 in 1936, to 11.0 in 1955. The infant mortality rate has dropped from 166 in 1936 to 71 in 1955, while the maternal mortality rate is now 4.1, as compared with 21.6 per thousand live births in 1936.

The major reductions in mortality rates occurred between the year 1946 and 1947, and it is certainly no coincidence that these reductions have followed the concentrated anti-malaria campaign of 1946.

TABLE I. Comparison of mortality rates in Ceylon in 1946 and 1947.

Mortality rates (per 1,000)	1946	1947
Total	20.2	14.3
Infant	141.0	101.0
Maternal	15.5	10.6

Prematurity is considered to be responsible for over 20 per cent. of infants' death and one third of all births are classified as premature. " Convulsions " were responsible for 19 per cent. of all infant deaths in 1952 and for 17.2 per cent. in 1954. *Rathé* (Sinhalese for red) is listed as the cause of 12 per cent. of all infant deaths in 1952. No cases of *rathé* are reported beyond one year of age. According to DE SILVA (1956), this term includes various skin diseases as well as congenital syphilis.

Another cause of death in infancy and childhood specific to Ceylon is known as *mandama*. Most cases thus diagnosed would come under the heading of malnutrition — but, according to DE SILVA (1956) some are probably suffering from nephritis, intestinal parasitism, diarrhoea and anaemia.

The stillbirth rate is reported to be 48 per 1,000 live births and over 50 per cent. of all infant deaths occur in the neonatal period (ABHAYRATNE, 1948).

HEALTH CENTRES

The existing maternal and child health activities were developed from domiciliary midwifery services initiated in 1926, when one medical officer, two public health nurses and four midwives constituted the total staff.

The main work is done in health centres. These centres are organized by the Department of Health with the assistance of local authorities, except in those municipal areas, where the responsible authority is the Municipality.

The Government pays grants to local authorities to assist them in the provision of buildings, equipment and dietary supplements. Personnel, mainly midwives, is provided by the Department of Health. These units hold fortnightly clinics for ante-natal and post-natal care, and fortnightly sessions for infants and toddlers. The total number of health centres at present is 768. The staff available consists of 104 medical officers, 108 public health nurses and 1,152 midwives.

SCHOOL HEALTH SERVICES

The number of schools in Ceylon exceeds 6,000 with about 1.6 million pupils. Roughly 10 per cent. of the school children are examined annually.

There is no separate school health organization and the work is carried out by the regular health staff, assisted by the teachers. The parents are advised to be present during the examination.

Correction of discovered defects is attempted either in special clinics held at the schools or in outpatients departments. All children are vaccinated against small-pox and inoculated against typhoid. Where ankylostomiasis is prevalent, routine treatment is given. A mid-day meal is given to all pupils up to the 5th standard. Originally the meal consisted of only a bun, but now, with assistance from CARE Organization, a glass of milk is given in addition.

Increasing attention is being paid to the teeth of the children. For this purpose, ten dental clinics were established in Colombo, and these are in the charge of dental nurses trained in New Zealand. With assistance from the Government of New Zealand, a school for dental nurses has been established. The course takes two years and thirty-one nurses are under training at present.

The following nutritional " defects " have been found in 11,554 school children in Colombo : underweight, 24.4 per cent., vitamin A deficiency 46.3 per cent., riboflavin deficiency 6.7 per cent, and anaemia 23.9 per cent. It is stated that infections with Ascaris are very frequently the cause of death in school-age children.

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FAMILY PLANNING AND MATERNITY SERVICES

Advice on family planning is given at the ante-natal and post-natal clinics. The Government is also supporting work in this direction sponsored by Voluntary Organizations.

Institutional midwifery is done in two maternity hospitals in Colombo, in 230 general hospitals and in 125 maternity homes throughout the country.

The total number of maternity beds at present is 4,645 and the number of midwives employed in institutions is 768. Institutional deliveries are becoming more and more popular as shown in Table II.

TABLE II. Percentage of babies delivered in institutions in Ceylon.

Year	Total births in year	Total admitted to institutions	Percentage of deliveries in institutions.
1947	271,191	42,527	15.7
1948	287,695	54,681	19.0
1949	291,191	62,597	21.5
1950	304,635	115,585	37.9
1951	313,662	131,498	41.9
1952	313,532	133,147	42.5
1953	321,217	144,469	45.0
1954	303,894	141,244	46.5

Domiciliary midwifery is also developing and at present some 25 per cent. of the total number of deliveries are conducted in the homes by Government employed midwives. Another 15 - 20 per cent. of all deliveries are conducted by private practitioners or in private institutions. Thus, only about 10 per cent. are delivered by indigenous midwives — *gode vinnappa amma.* Recently, it has been decided to create mobile obstetric units to deal with field emergencies.

PEDIATRIC CARE

There is a large modern pediatric department of the Medical Faculty at the University of Ceylon, in charge of a pediatrician of international reputation. In provincial hospitals, there are either separate pediatric wards or children's beds in general wards. Pediatric out-patients are usually seen in the general clinics. Mothers are not as a rule welcomed in children's wards, although they are often present.

In Kalutara, a pediatrician provided by WHO is now experimenting with the integration of promotional, preventive and hospital and domiciliary services for children. There are 13 qualified pediatricians in the country.

The chair of pediatrics was established in 1949. Recently, children's wards under the care of pediatricians have been opened in four provincial hospitals and in Colombo North and Kalutara hospitals. The total number of children's beds is 750. There are 40 beds for children in a tuberculosis hospital outside Colombo and a separate 100-bed hospital for children suffering from tuberculosis has been opened recently.

In 1954, a National Council of Child and Youth Welfare of Ceylon was inaugurated by a group of social workers. It is supported by the Government and among the activities of the Council are the establishment of a home for destitute children, a day-nursery for the children of working mothers, a holiday home for children, the supply of food to the children of mothers suffering from tuberculosis, and a convalescent home for children. The Ceylon branch of the United Nations Appeal for Children is building a convalescent home for children. The main object of this home is to build up malnourished children after discharge from hospital.

PERSONNEL

The backbone of the maternal and child health services are the midwives. 1,281 midwives work under the Department of Health, and 130 under local authorities. The training is of 18 months duration — one year in an institution and 6 months at a field training centre. Training includes domiciliary midwivery and basic elements of child care and public health. Each midwife serves a population of about 4,000.

The functions of the midwives are to give prenatal, natal and post-natal care to the mothers and to look after the infants and pre-school children in areas where there are no public health nurses. Where public health nurses are available, the midwives care for infants only up to the tenth day after birth.

In order to become a public health nurse, it is necessary for a general nurse to undergo additional training in midwifery for a period of 9 to 12 months and a similar period of training in public health nursing. 125 public health nurses work under the Department of Health and 30 under local authorities. A new category — the supervising midwife — has been created recently for work at the district level.

There are also 900 so-called " apothecaries " in the Department of Health. These are pharmaceutists with elementary training in medicine.

LEGISLATION

Maternity Benefits. Under the " Maternity Benefits Ordinance " passed in 1939, an expectant mother is entitled to two weeks leave on full-pay preceding her confinement and four weeks after her confinement. The employer is expected to pay these benefits within 48 hours of the production of proof of confinement, and the amount paid for the subsequent period may be in two instalments, at the end of the 2nd and 4th weeks respectively after confinement.

Further maternity benefits are provided under the " Medical Wants Ordinance " for resident labour on estates. In this case, it is the responsibility of the Superintendent of an Estate to provide sufficient food and lodging for one month after the birth of a child to a female labourer on an estate.

Employment of Females, Young Persons and Children's Act. According to the requirements of this Ordinance a child under 14 years cannot be employed in any industrial undertaking. Women cannot be employed at night in any industrial undertaking, except under special circumstances.

Employment of Females in Mines Act. By this Act, no female of any age is permitted to be employed in any underground work in any mine. This does not include females employed in welfare clinics.

Orphanages Ordinance. Orphanages at present are chiefly run by voluntary organizations to which the Central Government gives grants through the Department of Social

Services. This ordinance provides for the better control and supervision of these orphanages. Medical supervision at these orphanages is carried out by medical officers of the Department of Health.

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ADDENDUM

MATERNAL AND CHILD HEALTH SERVICES IN S.E. ASIA

(DEVELOPMENTS UP TO APRIL, 1957)

by
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(*W.H.O. Adviser in Maternal and Child Health, Regional Office for S.E. Asia, New Delhi*)

In India, the attitude towards, and the practice of, field maternal and child health services, outside cities and towns, has lately undergone a radical change, and the present trend is to develop " health units " of which MCH constitutes an integral part.

The pattern, as laid down in the Second Five Year Plan (1956 - 61), is based on the " primary centre," serving a population of 60,000 and covering about one hundred villages. The staff consists of one medical officer, one health visitor or public health-oriented nurse, one sanitarian, four midwives or auxiliary nurse-midwives and ancillary staff. There are three sub-centres under the jurisdiction of the primary centre, each staffed by one of the four midwives, the fourth being attached to the main unit. Such primary health centres are set up in areas under the Government's Community Development Programme, and the Second Five Year Plan envisages the establishment of 2,640 units before March, 1961 in an attempt to cover about 50 per cent. of the rural population.

In the administrative field, changes have taken place as a result of the re-organization of the States which came in force on November 1, 1956. There are now only 14 States (including Jammu and Kashmir) as compared with the former 29, and there is an assistant director for MCH in each of these newly formed States. In addition, there are also a number of regional MCH officers.

Pediatrics has recently been recognised in a number of medical colleges as an independent discipline, and more time is now devoted to the study of this subject. In a few of the medical colleges, promotional and preventive child care has been included in the curriculum.

Public Health is being integrated in the nursing curriculum, and in some States hospital nurses are undergoing orientation courses in public health. The training of health visitors is planned to be discontinued altogether in 1961. Also, all midwifery schools are being converted into schools for " auxiliary nurse-midwives " with a strong public health bias in the curriculum.

In Afghanistan, it has not been possible to keep up the initial quick pace of development, described in our second article. The main obstacles are the customs connected with *purdah*, which limit the potential number of female health personnel, curtail their freedom of movement, and practically exclude males from direct services to women and, indirectly, also, to a certain degree to children.

The proposed integration of the ante-natal and well-baby clinics has not yet taken place, but one additional ante-natal clinic and one child welfare clinic were established in Kabul.

Until recently medical students, who are all males, had no practical training in midwifery. It has now been agreed that they will work two at a time at the Shararah Hospital, as well as in child welfare clinics.

The nursing school had been temporarily closed in 1955, but re-opened again in 1956 with six students. The number of qualified midwives has risen to 44, but only three qualified in 1956. Midwives are now also being trained in the town of Herat, and 13 students will be ready for examination before the end of 1957.

The experiment in training local girls in Kandahar to work as " auxiliary nurse-midwives," now renamed " nurse-midwife helpers," was quite successful and has opened new possibilities for provision of health personnel in the provinces as well as in the capital. The initial success is considered promising since Kandahar is the most orthodox town in Afghanistan.

The Government has posted six medical officers trained in MCH to the provincial towns of Baghlan, Khost, Ghazni, Mazar-i-Sherif, Herat and Jellalabad, and MCH centres are being established there.

School Health Services were not mentioned in the original article of Afghanistan. There is one school health clinic at present in Kabul with a medical officer and three assistant medical officers. Information is at present being collected on the existing schools in order to formulate a programme for the future.

The pilot rural health service in Shewaki near Kabul, started in 1954, has made some progress. It is estimated that approximately one quarter of the child population is receiving care. Another health centre to cover additional 10 villages has been established in 1956 in Chaurazia, near Shewaki.

The number of health units in Burma is now 270 and these are staffed as follows :

With a health assistant only	86
With a health assistant and a health visitor	5
With a health assistant and one midwife	135
With a health assistant and 2 - 5 midwives	44

The target is to establish 430 rural health centres by the end of 1959.

It appears that for a considerable time to come the midwives will remain the backbone of MCH work in Burma. There are 43 midwifery schools in Burma with a total of 400 students of whom 200 are trained in Rangoon at the Lady Dufferin Hospital. The students of this school have two months' training in domiciliary midwifery and, during this period, they also visit MCH centres. The training is similar in Mandalay, with 36 students, but the remaining 164 students are spread over 41 " training centres " with very inadequate teaching facilities.

Recently increased attention has been paid to school health services and, in four towns (Rangoon, Mandalay, Bassein and Moulmein), these are being integrated with the general MCH services.

The training of health assistants which has been discontinued was resumed and the fourth batch graduated in December 1956. 21 " public health inspectors " underwent one year's training in 1956 and qualified as health assistants.

Indonesia also is moving into the field of rural health. The national programme of Community Development was started on 17 August, 1956. The working unit is a district with approximately 100,000 population. It is planned to establish sixteen such units each year.

Services. This ordinance provides for the better control and supervision of these orphanages. Medical supervision at these orphanages is carried out by medical officers of the Department of Health.

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ADDENDUM

MATERNAL AND CHILD HEALTH SERVICES IN S.E. ASIA

(Developments up to April, 1957)

by

P. Robinson

(W.H.O. Adviser in Maternal and Child Health, Regional Office for S.E. Asia, New Delhi)

In India, the attitude towards, and the practice of, field maternal and child health services, outside cities and towns, has lately undergone a radical change, and the present trend is to develop " health units " of which MCH constitutes an integral part.

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INFANT FEEDING IN THE VILLAGE OF GUINHANGDAN, LEYTE, PHILIPPINES

by

ETHEL NURGE, PH.D.*

(*Department of Economics, Sociology and Anthropology, Goucher College, Baltimore*)

Guinhangdan is a small agricultural fishing village on the national road in north-eastern Leyte. Two kilometers to the north is a town ; 17 kilometers to the north is the provincial capital. Two hundred and sixty families live a quiet peaceful life, extracting nourishment from the fields or sea and partaking in the expanding money economy of the region to an ever greater degree. Many of the customs of the people of Guinhangdan are traditional ones ; that is, they are sanctioned by centuries of practice and by a force of strong conservatism. On the other hand, some customs are but newly or recently introduced and these lack the force and unanimity of the older ones. We are considering in this article both the established habits and the newly introduced customs relevant to the feeding and weaning of infants. Innovation in child training practices in a rural area is especially interesting in an era in which so much thought, money, and planning is being devoted to the economic and social betterment of villages throughout the Philippines, because it has been demonstrated time and again that parents will undertake new behaviours for the betterment of their children's lives when they may not exert themselves nor change their ways of doing things on their own behalf. In what directions then, in what aspects, are *barrio* children being breast fed and weaned which represent a departure from the age-old ways ? And, what are the age-old ways ?

This report is based on two sources of information : (1) eight months of residence in the village and observation and participation in the daily routine of the people and (2) a detailed questionnaire on child feeding practices employed on seventeen mothers. Twelve of the mothers were carefully chosen with the view in mind of tapping any variability which might be traced to a range of socio-economic standards and opportunities.

Before delivery a pregnant women does not eat special foods to nourish her baby or strengthen herself. In rare cases a thoughtful and provident husband may raise chickens or beg eggs and chickens from his parents in order that his wife may have the psychological and nutritional benefit of eating raw or cooked eggs, or chicken during pregnancy.

Before birth the mother does nothing to prepare her breasts for nursing. The child is born in the house and the mother is assisted in delivery by her male relatives and by the female midwife. Neonates are given a purgative immediately after birth and are not nursed until the second or third day, because the mother considers colostrum unfit food for the child. Twins are not considered lucky or unlucky, although they may present a problem if the mother cannot breast-feed the two and if the family have a very small income. No special care is given to twins or to premature babies. Both twins and the birth of premature babies are believed to be evidences of God's will and are accepted unquestioningly.

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* A Fulbright grant for the academic year 1955-56, during which time the writer was affiliated with Silliman University, made possible the field work in Leyte. I am indebted to the United States Educational Foundation for their support, and to Dr. M. Farooq of the World Health Organisation whose interest in the subject influenced the writing of this report.

The Journal of Tropical Pediatrics, September, 1957

A rural health pilot project has been established with the assistance of I.C.A. at Bekasi, a regency adjoining Djakarta. There will be a training centre for rural health personnel with a 25-bed hospital.

Work is also planned on sub-district level with a population of 25,000 approximately. On the village level, there will be a village health worker called *pendidi kikian*, who will be trained for two years after graduation from a primary school. This worker will be supervised by a *pengawatkikian*, who will be selected *pendidikikian* with additional 1½ year training.

Eventually, existing MCH centres, polyclinics and hospitals will be integrated in the health centres.

Hitherto there were 28 different categories of auxiliary health personnel in Indonesia, mostly trained on the " hospital attendance system " and not in formal schools. There were no minimum educational requirements.

It has now been decided to establish two types of schools. Primary school education will be a basic condition for admission. The lower type school is for *Djuru Kesehetan* (basic medical training). Graduates will qualify after 12 months training and one year practical experience to become small-pox vaccinators, aides in yaws campaign and in MCH.

After an additional one year theoretical training in the *Pengamat Kesehetan* (advanced medical training), school graduates will qualify for Certificate A (tuberculosis, leprosy, eye diseases, V.D. and home visitors in the fields of MCH, TB and nutrition) and B (Malaria, Plague, Health Education and Environmental Sanitation).

Graduates of the basic medical training course may receive an additional one year's theoretical and one year's practical training to qualify for certificates C (general nursing), D (mental nursing), E (midwifery), F (laboratory assistance), G (dipsensary workers) and H (X-ray technician).

In Thailand, Rural Health Development has started with I.C.A. assistance in four areas : Korat, Minburi, Chalburi and Puket. The latter, a small island province, has been selected for a pilot project.

The plan for rural health services, as now defined, calls for a health centre for a population of 50,000. The staff will consist of one doctor, one nurse, one midwife and one sanitarian. A second class health centre will serve a population of 5,000 and the staff will consist of one midwife and one sanitarian. For each village or group of villages with a population of 2,000 there will be one midwife.

At the district level (471 districts), there will be a public health officer, an assistant public health officer, one nurse supervisor and two sanitarians.

Since 1953, 427 new midwives have received basic training and 612 trained midwives had completed a six weeks' refresher course. His Majesty the King is very interested in MCH activities and recently donated two mobile units to the MCH Division.

Labour Legislation, enacted late in 1956, became effective on 26th of February, 1957. This, among other things, has certain health features which cover the provision of clinics, nurses, doctors, and states the circumstances under which their services must be utilized.

In Ceylon, a special officer to deal with juvenile delinquency has been appointed. His terms of reference have been defined as follows :

(1) Report on co-ordinating the juvenile welfare services of the State.
(2) Revise the existing provisions regarding juvenile delinquency.
(3) Prepare regulations for implementing the provisions, and
(4) Report on the expansion of institutional care of young delinquents.

whether or not the milk of these mammals is good for a child and very few mothers have ever made any attempt to use them. Mothers are unanimous in their opinion of canned milk, however, feeling that canned milk is good, because it contains "substances" and because the baby thrives on these substances, but when the women are pressed to define these "substances," they cannot. We may perhaps have here the first glimmerings of an understanding of the nature of vitamins and their part in nutrition. The use of the canned milk which is, again, a relatively recent innovation in infant feeding, is attributed by users to the fact that they have heard it was good and, in all probability, they procured this information from their better educated peers. Most mothers make some use of canned milk while they are still suckling their young, but the number of mothers who use it and the amount which they use is limited by low cash incomes*. The canned milk used is more often condensed than evaporated and is always diluted with water, generally in equal amounts although sometimes the mixture is two parts of water to one part of milk. Sugar is always added to the mixture of evaporated milk and water : the sugar may be either white or brown, brown being used more frequently for reasons of economy. Feeding bottles are not commonly used, but when they are, they are soft drink bottles with a rubber nipple attached. Practically no use is made of powdered milk because it is remarkably expensive in this area. In the provincial capital, powdered milk was priced at the largest grocery supply store. Six brands of powdered *whole* milk were found to range in price from *P* 2.00 to *P*2.65 per pound. Two and one half pound cans of four brands sold for *P*4.30 to *P*6.00. A five pound can, offered in one brand only, cost *P*9.20. A single brand of powdered *skim* milk was on sale and cost *P*9.5 for 9.6 ounces or what is roughly 3 quarts when prepared. Besides the high cost of powdered milk, the very fact that it needs preparation militates against the likelihood of its widespread acceptance. The average Filipino mother would much rather puncture a can than beat a mixture of powder and water. Under the best of conditions in a modern kitchen, the preparation of powdered milk is facilitated by a vigorous beating with an egg beater and, even then, the lumps are not always dissolved. The Filipino housewife has no egg beater and she uses a spoon and the resultant product is lumpy. Furthermore, because she lacks refrigeration she could not, if she would, prepare milk in any quantity and store it for any length of time.

When powdered milk from welfare sources is distributed to the *barrio*, it is given to the principal of the school who instructs the school children to bring a piece of paper or cup to receive it. This the children do and many eat it immediately in its powdered state. Not all children like the taste. Nobody has reported attempting a mixture with mashed bananas or mixing the powder into the popular rice gruel for babies, but it would seem that both possibilities are worth exploring.

SUPPLEMENTARY FEEDING

Supplementary feeding may be introduced into the baby's diet for a number of reasons—the mother's milk may be lessening or the child may no longer obtain sufficient nourishment from the breast milk alone. Sometimes the mother desires greater personal freedom and begins to give the child supplementary foods in order that she may work away

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Breast feeding by the third day is normally routine, but if lactation does not begin by then, one of a wide variety of techniques to induce it may be adopted. These include the drinking of *tuba** or coffee, the eating of boiled *camote* or *tangkong* leaves, or the eating of stewed chicken or clams, the drinking of fish or meat broth, or of a thin porridge made with cocoa and sugar, or the eating of young coconut stewed with crabs. The mother may dip her breasts into half coconut shells in which water boiled with herbs or with clam shells has been poured ; she may comb the breasts downward with an ordinary comb purchased in the market ; or she may have the midwife massage her back. No permanent lactation failure was described, although one mother reported a light flow and she was one of the few who are fortunate enough to have money to use canned milk as supplementary food. If the mother had what she deemed an excess of milk, she generally did nothing about it, although one woman used a breast pump to express it and throw it away. Most mothers had no troubles in the early months of breast-feeding although a few complained of an aching back and armpits or of swollen breasts and nipples. Occasionally a child is breast-fed by a woman who is not his mother, but this is true on a limited number of occasions only. If, for a few days, the natural mother cannot feed her child because of lactation failure, another woman may nurse him. Also, now and then, in the early months of a child's life the mother is away for a protracted period and her babe suffers hunger and cries continuously in unappeased agitation. On such occasions, a lactating mother nearby will breast-feed the child. This is a friendly and neighbourly act and no payment is involved.

The initiation of breast-feeding is simple and without ceremony. A few mothers wash their nipples with water, but the percentage who do so is very small and the practice is due to the fact that such mothers have been exposed to what is sometimes termed " advanced " teaching in child care. The baby may be fed while the mother is lying down or sitting. When the mother is sitting, she may cuddle the child in her arms holding it to the breast, or she may let the child lie across her thighs and bend a little to feed him. The baby is generally put to both breasts at each feeding and he sucks as long as he wishes or until he falls asleep. Besides being offered as food, the breast is offered as solace when the child is irritated or in pain. Nursing the child is an affectionate action on the mother's part and she is both gentle and indulgent during the act. The infants are fed whenever they cry during the day or during the night until they are weaned and, although exceptions occur, they are rare. Permissive demand feeding, then, is the general rule, but adherents to " new " ideas in feeding behaviour are to be found. Two women reported that they practised rigidly scheduled feeding. They had been introduced to this novel practice by " educated " people. One of the mothers was a teacher and the other had a sister married to a college teacher. It is ironical that the currently popular breast-feeding practices in middle class American homes represent a return to non-scheduled, permissive, indulgent feeding. The latest findings of psychologists and child health authorities substantiate the superiority of permissive feeding, but because of the lag between the time of the findings and the transmission of the knowledge to mothers in the *barrio*, many Filipino babies will undoubtedly be subjected to rigidly scheduled feeding.

Theoretically, *barrio* mothers might have made use of cow's milk, goat milk, or *carabao* milk, inasmuch as all three animals are found in the *barrio*, but, in actuality, no use is made of any of them. When questioned, mothers say that they do not know whether or not the milk of these mammals is good for a child and very few mothers have ever made any attempt to use them. Mothers are unanimous in their opinion of canned milk, however, feeling that canned milk is good, because it contains " substances " and because the baby thrives on these substances, but when the women are pressed to define these " substances," they cannot. We may perhaps have here the first glimmerings of an understanding of the nature of vitamins and their part in nutrition. The use of the canned milk which is, again, a relatively recent innovation in infant feeding, is attributed by users to the fact that they have heard it was good and, in all probability, they procured this information from their better educated peers. Most mothers make some use of canned milk while they are still suckling their young, but the number of mothers who use it and the amount which they use is limited by low cash incomes[*]. The canned milk used is more often condensed than evaporated and is always diluted with water, generally in equal amounts although sometimes the mixture is two parts of water to one part of milk. Sugar is always added to the mixture of evaporated milk and water : the sugar may be either white or brown, brown being used more frequently for reasons of economy. Feeding bottles are not commonly used, but when they are, they are soft drink bottles with a rubber nipple attached. Practically no use is made of powdered milk because it is remarkably expensive in this area. In the provincial capital, powdered milk was priced at the largest grocery supply store. Six brands of powdered *whole* milk were found to range in price from *P* 2.00 to *P*2.65 per pound. Two and one half pound cans of four brands sold for *P*4.30 to *P*6.00. A five pound can, offered in one brand only, cost *P*9.20. A single brand of powdered *skim* milk was on sale and cost *P*9.5 for 9.6 ounces or what is roughly 3 quarts when prepared. Besides the high cost of powdered milk, the very fact that it needs preparation militates against the likelihood of its widespread acceptance. The average Filipino mother would much rather puncture a can than beat a mixture of powder and water. Under the best of conditions in a modern kitchen, the preparation of powdered milk is facilitated by a vigorous beating with an egg beater and, even then, the lumps are not always dissolved. The Filipino housewife has no egg beater and she uses a spoon and the resultant product is lumpy. Furthermore, because she lacks refrigeration she could not, if she would, prepare milk in any quantity and store it for any length of time.

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* It is a personal estimate that one quarter of the mothers can afford no canned milk at all. In the price listing that follows, the Philippine monetary system is used. The "*P*" is a *peso* worth fifty U.S. cents or approximately 3/6 in sterling. Two Philippine *centavos* are equal to one U.S. penny (cent).

A baby's first experience with food other than human milk is generally an offering of mashed bananas or rice and water gruel. Bananas are not pre-chewed, but they are mashed and fed with either a spoon or the fingers, although sometimes they are peeled and given whole. The child may receive a banana only a few times a week, but more commonly babies are fed bananas two or three times a day. *Costa* is the most popular variety and the *inaldaba* is not used*. The need for ripeness and softness is appreciated and indigestion is attributed to hard or unripe bananas. The rice gruel is thin and well cooked. Sugar is rarely added, but a pinch of salt is occasionally stirred in. When a mother can afford it, she may add an egg or milk. (On the other hand, one mother narrated a belief that eggs were bad for the teeth). Two tablespoonsful of porridge at a feeding seem to be the average quantity and the child may eat that much twice a day. Almost all mothers feed their children salted and sweet crackers and soft bread now and then. The protein food fish is, unfortunately, not part of the child's diet as it is considered to cause hookworm. Again, unfortunately, fruits, other than bananas, and vegetables are rarely fed to the child. Because of existing food prejudices, it is inconceivable to many women that they are important. On rare occasions, then, the suckling infant will have tastes of boiled string beans or *camote* roots in coconut cream, or spooned papaya, avocado mixed with sugar and evaporated milk, or mango. The child will not be fed any food cooked with *tuba* vinegar or *lemoncito* juice as these are sour and are believed to cause stomach ache. The juice of oranges, however, is acceptable and even considered beneficial. The water in young coconuts, and *camotes* and *idaldaba* bananas, while not sour in their natural state, are believed to turn sour, once they enter the stomach. Babies are not given *tuba* to drink as a general rule although there is no belief that the practice has any harmful effects if the beverage is given in moderate amounts. It is recognised as a soporific and is also, unfortunately, administered to " cure " hookworm.

The use of separate utensils and dishes for the preparations and serving of baby's food is beginning to be recognized as a cautious and commendable one. However, even if baby has some items exclusively for his personal use, there are apt to be others such as a spoon or a pot which are in the service of the family in common. In learning to eat solids and semi-solids and to accept substances from the spoon instead of a nipple, the child exhibits the normal motor difficulties encountered by babies anywhere. He tends to push the food out with the tongue until he learns to swallow. Some babies grab the food and throw it. Two mothers reported temporary digestive upsets at the time of introduction of supplementary foods : one baby got constipated and one had diarrhoea. When the baby rejects food by effortless vomiting, he is not fed any further. Under no circumstances is he forced to eat by prolonged coaxing or distraction-type playing.

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* *Costa* is a variety of banana which becomes yellow when it ripens. It is similar to the variety so popular in America, except that it is smaller, about one half the size, and sweeter to the taste. *Inaldaba*, as well as *baloy*, another type to be mentioned, do not turn yellow when they ripen, but remain green.

When they are asked what foods are good for the baby who is still breast feeding, mothers agree on bananas, porridge and crackers. With less unanimity they will list eggs, papaya, or orange juice. The " goodness " of a food is judged by its digestibility and according to whether or not the baby thrives on it. Obvious growth increase pleases the mothers and *a priori* they assume that, if they are feeding the child the locally approved foods, the child is experiencing an increase in blood as well as an increase in size. Foods which are considered bad are primarily hard foods and all mothers are in agreement about the need of avoidance of hard foods in the baby's diet. The items which they include under hard foods are, unripe bananas, *inaldaba* and *baloy* varieties whether ripe or not, roots, stale bread, locally made crackers which are dense in texture and difficult to chew (but not crisp crackers packaged elsewhere) guavas, and ripe jackfruit. With less consensus mother think too many sweets or a variety of foods, or too much meat, or sticky rice, or sour foods will make the baby ill. Most of the baby's illnesses are defined as indigestion, with fever, frequent bowel movement, and stomach ache being the common symptoms. The most popular therapy is the administration of a patent medicine purgative. One mother, who is among the better educated and who lived in town for many years, reported that she administers an enema. As to the majority of the mothers who lack the funds for patent medicines, or who do not put much faith in their use, resort is made to home remedies. These include giving the baby strong black coffee to drink or rubbing a popular, patent salve or vinegar on the belly. A traditional remedy is the drying of tobacco leaves over live coals and then mixing them with the mother's milk and rubbing the sodden wad on the child's stomach. The milk of the mother is supposed to be an " enemy " to what ails the baby.

Whether or not a woman believes she can get pregnant again while lactating sometimes has bearing, one way or another, on the length of time she will breast-feed the child. In this respect, it is interesting to note that the Guinhangdan mothers in the present sample were almost divided in their opinion as to the effect of lactation on possible impregnation. Almost half the women stated unequivocally that they could not get pregnant while breast-feeding and a little over half believed, or knew through experience, that they could conceive while lactating. Older mothers sometimes generalize about their fertility rate stating that they get pregnant every three years or every one year and eight months. The writer found by checking the birth dates of their live and dead children that they are generally not accurate in their suppositions.

During breast-feeding, mothers are concerned as to how to increase their milk supply, but they are not concerned with their overall general health. Thus, they have traditional procedures which are believed to ensure an abundant flow of milk and these generally include the use of liquids of various kinds : broth from vegetables, fish, or meat or *tuba*. Clams and crabs are favourite sea foods because of their supposed milk-making properties and *tuba* is believed to be strengthening. Leafy vegetables are sometimes included in the diet of a lactating mother, but not in any significant amount. Milk of any kind is not popular, although some of the more educated women drink evaporated milk diluted with an equal amount of water with sugar added, or condensed milk diluted in the same proportion with no sugar added. There is evidence that many mothers believe that they ought to provide themselves and their children with canned milk. However, they have not taken to the idea of using milk for themselves with any outstanding enthusiasm. It ought to be remembered that poverty prevents many from using milk, who might be among those to do so if they had the means. As to food avoidances for lactating mothers, the most common item which is deemed harmful is anything sour. Sour food include oranges (but not the juice) and *guavano,* and any dish prepared with vinegar, *lemoncito* or *batwan* (a type of lemon). The next most important kind of food which it is believed necessary to avoid is prickly foods, that is, food which in their uncooked state are rough in texture. The leaves of the *gabi* plant are an example. These foods are held to be particularly harmful if the baby is suffering from a skin disease. The prickly quality is believed to be ingested by the mother and passed through her milk to the child, worsening the itchy condition. Furthermore, if the child has boils, it is believed that the mother should not eat jackfruit or pineapple because the smell of the fruit is not good for the boil and may aggravate the condition.

SEPARATION FROM THE BREAST

Supplementary feeding and the refusal of the breast to the child are generally not distinguished by writers who place both indiscriminately under the term, weaning. The weaning process is a slow one and may be subdivided into several stages, of which the introduction of supplementary foods is the first step, the refusal of the breast the second, and the full participation of the child in the family's normal table-fare, the third or final step. The age of the child when the mother refuses the breast in Guinhangdan is generally between 1 and 1½ years. The earliest recorded age was 8 months and the latest was three years. Often, when a child is first refused the breast it is because the mother is pregnant again and it is commonly believed that it is not propitious for a child to be suckled once the mother has conceived again. Or else the child may have progressed in the eating of solids and semi-solids to a point where he no longer needs breast milk. Once a child can eat rice a mother feels he can extract sufficient nourishment from that basic staple to warrant ceasing breast-feeding. The mother might also stop feeding the child for personal considerations. Perhaps, she wants to harvest and must, therefore, be freed from the burden of attending to the child every few hours. And sometimes the growth of the child's teeth and its experimental and aggressive biting hasten the day of its separation from the breast. To aid her in freeing the child from the breast, the mother has recourse to a number of techniques, designed to frighten or repulse. Almost all mothers use one or another of these techniques but one mother was informed enough of modern views so that she effected the separation without recourse to any. Application of pounded ginger, pounded roots, or garlic to the nipples are common practices to discourage the suckling. One application may be sufficient, three are more common, and occasionally, a persistent child may cause the mother to coat her nipples for as many as four days. Use may be made of pepper or charcoal or the mother may simply apply any leaf and depend on her accompanying explanation to repulse the child. She may tell him the nipple is " dirty " or " hot ". In any event, by word and manner, she withdraws the nourishment and consolation of the act of breast-feeding and forces the child into his next developmental stage.

Almost all mothers complained of swollen or painful breasts at initial cessation of breast feeding of any particular child. The child is almost always cranky at this time and the mother may minimize her bodily contact with him, but he is almost never sent away from the home. Most frequently, pacification is attempted with offerings of canned milk, crackers, or bananas. At this time, the eldest sibling, male or female, or the husband, or any family member who lives in the house may take increasing responsibility for the care of the weanling, as he reluctantly becomes less dependent on his mother for his food supply. The period necessary to effect complete separation from the breast is generally a short one ; sometimes three days is a sufficient time lapse, although more commonly it takes two weeks.

The age at which the weanling eats the full family diet is normally one and a half years, although sometimes it may be as early as one or as late as two. Full participation in the routine family diet may precede separation from breast nourishment, and, considering the circumscribed diet of some families, this is not surprising.

Most mothers have no practice, traditional or otherwise, designed to stop the flow of milk once they cease breast-feeding. A piece of cloth dipped in warm water is applied to the breast by a few women and one mother believed in the magical properties of rice water applied to the nipples, while another gathered the flowers of a male papaya plant and wove a garland which she wore around her neck.

DISCUSSION

In attempting to modify the existing child feeding habits of village people, planners will have to take into consideration the present patterns of feeding and the beliefs about food and digestion which are so interwoven and which are so vital a part of the complex whole. Where changes have not been adopted we must look to the structure of culture and the nature of the dynamics of culture change or culture stability for an explanation. In general, it is true that those changes which represent the least departure from the customary way of doing things have the greatest chance of acceptance once their superiority is demonstrated. Secondly, it is a valid generalisation that those changes which are radically different from the established culture patterns have the least chance of acceptance. And, finally, if a proposed novelty conflicts with some deep and emotional belief about the nature of man and his proper relation to the universe, it will not be accepted.

To summarise the present findings, we can say that, historically, the neonate was permissively fed on-demand, but that to-day a fad which is already declining elsewhere — strictly scheduled feeding — is beginning to be accepted in the *barrio*. Traditionally, feeding bottles were not employed in the early months of life and the infant was probably fed from a coconut shell, but to-day chinaware bowls and even soft drink bottles are often adapted by mothers. Furthermore, there is no reason to believe that separate utensils for baby's use was a custom in former times and to-day such a practice has some adherents. The most significant change which has come about in infant feeding habits, however, concerns the use of milk other than human. It is highly improbable that there is a precedent for the use of non-human milk in old Guinhangdan. To-day the amount of canned milk which is being used by mothers is encouragingly significant and there is, furthermore, reason to believe that such supplementary and routine use will be extended when, and if, standards of living are raised. Cow's milk in another form, powdered milk, may eventually play a larger part in infant and child diet than it does to-day. This is especially likely if welfare sources make available regular and continuing supplies and if some experimental work is undertaken to ascertain the forms in which the powder will be most acceptable to the people. On the other hand, the use of goat's *carabao's*, or cow's milk in any quantity awaits developments both in public health on a national level and maternal health education on the *barrio* level.

To continue the comparisons between ancient and modern practices, it can be inferred that historically the weanling was not fed fruits, vegetables, meat, or fish, and in this respect the picture to-day is not encouraging, for little change has been made in this particular configuration of eating habits. Further improvements in diet through increase of items and diversification of nutrients is, to a large degree, improbable while the conception of rice as a whole and perfect food continues to have the wide credence it has. Such a conception of the completeness and wholesomeness of the basic staple in the Philippines is particularly obdurate and has proved most difficult to supplant.

One of the most tenacious of ancient practices is the disguise either visual, olfactory, or bad tasting, which is applied to the mother's nipples in the second stage of weaning. This is symbolic of the separation to come and there is probably a certain amount of *satisfaction for the mother in it. Certain it was that the* mothers frequently, in narrating their experiences in this period, were both pleased with themselves for the ingenuity of their techniques and uncompassionately amused at their offspring's frustration. Whether teachings, to the effect that such symbolic disguise before separation is unnecessary in order to effect the separation, will have any widespread acceptance among *barrio* mothers remains to be seen.

Notions about hard foods or sour foods being bad for the baby are probably age-old traditions. They have not changed, nor has the mother's knowledge of physiology as far as lactation is concerned. The age at which the child is separated from the breast may be undergoing a change, but we have no data on which to base inferences.

The foregoing comparisons demonstrate that innovations in feeding practices are still relatively few, both in regard to kinds of innovations and to numbers of acceptors among the mothers of Guinhangdan. However, in their sum total, the innovations evidence a greater willingness to experiment in matters of the child's welfare than in other areas of daily life. When the people who are responsible for the care and raising of the child are told that some new procedure will help their infant, they are far more willing to experiment and far quicker to try that new procedure than they are to tentatively adopt, say, innovations in ploughing or weeding. There are practical reasons for this as well as impractical ones. The emotional investment in child raising is much higher than the investment in land use. The response of a child to special care is more immediate and apparent, whereas the results of changes in a technique of land-use are slow in becoming evident and not so personally satisfying. Furthermore, the sums involved in adding small items to a baby's diet are small when compared with the capital necessary to bring about changes in agriculture. For these and other reasons, it is suggested that planners give more cognisance to the infant and child population as potential targets for education directed towards technical change.

ERRATUM

Vol. 3. No. 1. JUNE 1957. Correspondence : (1) "Rickets in the Tropics," by Cicely D. Williams. Line 11 ; for "Out of 200 consecutive admissions" *read* "Out of 2,000 consecutive admissions."

TRADE NOTE

New Sulfa Cuts Dosages 60 to 80 Per Cent.

A new sulfa product, " Lederkyn," which is so much more effective than the same amounts of other sulfas that dosages may be reduced 60 to 80 per cent. below quantities used hitherto, has been announced by Lederle Laboratories Division, American Cyanamid Company, and has just been made available in all countries.

Greater solubility and consequently more rapid absorption of the drug into the bloodstream are reported by Lederle scientists to be responsible for its greater potency. The effect of " Lederkyn " is also heightened by its unusually long retention in the body before being excreted in the urine. After extensive tests, clinicians have reported that side-effects from " Lederkyn " are few. The danger of such development as renal impairment through crystal formation is reported to be substantially less with " Lederkyn."

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EDITORIAL

TRICHURIASIS

The clinical significance of infection with the whipworm (*Trichuris trichiura*) is not widely appreciated, and, in many regions, this parasite is regarded as always non-pathogenic.

The reality of the situation is far different and, although low worm burdens are most usual and completely asymptomatic, numerous workers, including JUNG and BEAVER(1), have shown that high worm loads in young children are associated with a definite syndrome of chronic dysentery, anaemia, eosinophilia of some degree, and, in a small percentage of cases, prolapse of the rectum. In these cases, there will be a high faecal egg count and Charcot-Leyden crystals in the stools. Diagnosis is by stool examination and by sigmoidoscopy, when numerous whipworms can be seen attached to the walls of the rectum and sigmoid colon.

While the geographical pathology of clinical trichuriasis is unknown, in some subtropical areas, such as New Orleans, it is the commonest cause of chronic dysentery in young children — and this also seems to be so in some Caribbean regions, such as Cuba, the Dominican Republic, Puerto Rico and the Netherlands Antilles.

In areas where it is a common clinical problem, a major difficulty has been the absence of an effective form of therapy. Until recently the consensus of opinion has been that hexylresorcinol retention enemata are the best form of treatment, although inefficient and especially impracticable in many regions where the disease is widespread.

It is, therefore, with interest that one notes the preliminary communication by FRYE et al.(2), describing an apparently efficient and non-toxic trichuricide, known as Dithiazinine (3-3′ diethylthiadicarbocyanine iodide). This drug, which is administered orally, was used to treat 33 persons with asymptomatic light infections with the whipworm in doses of 200 mg. three times daily for 5 days, producing an 87.5 per cent. cure rate. Mention is also made in the same paper of further work in which children with actual whipworm dysentery have been successfully treated. The drug is also thought to have a definite ascaricidal effect.

It does, therefore, seem certain that, while much further corroborative work and toxicity studies are needed, Dithiazinine represents a valuable potential chemotherapeutic weapon for use in regions where childhood trichuriasis is a serious local pediatric problem.

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EXCERPT

ASPECTS OF NUTRITIONAL ANAEMIA IN PREGNANCY IN GAMBIA

(SCHOFIELD, F. D. *Trans. R. Soc. trop. Med. Hyg.*, 1957, **51**, 221.)

Eleven patients with anaemias of pregnancy were studied over a period of 4 months. Six with megaloblastic, one with normocytic, and one with microcytic anaemia were given a high protein dietary supplement, but no haematological response was observed.

A study of eight patients with tropical macrocytic anaemia of pregnancy and bone marrows containing " transitional megaloblasts " leads to the proposition that two factors are present in the aetiology of this anaemia as found in the Gambia : (i) a haemolytic factor, which ceases directly on delivery and, in the production of which past malarial infection can be suspected of playing a part ; (ii) a failure of utilization of haemopoietic substances in pregnancy which lasts for at least a week after delivery.

The findings are thought to provide evidence that, in the Gambia, dietary deficiency of haemopoietic substances, or direct competition for them between foetus and mother, are not major factors in the production of this anaemia.

PUBLIC HEALTH SIGNIFICANCE OF CHILD FEEDING PRACTICES OBSERVED IN A GUATEMALAN VILLAGE

by

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It is now recognized that protein malnutrition is a major cause of the high death rate among children of pre-school age in under-developed areas. Many efforts are therefore being made to change traditional practices in the feeding of young children. These usually consist of educational efforts to promote the use of suitable foods already available in the community or the attempted introduction of new food products. In either case it is important to understand the beliefs which underlie the inadequate feeding practices, and the attitudes which are unlikely to develop toward the proposed changes. These are frequently totally unexpected and may appear irrational to the health worker. Nevertheless, failure to take them into account may, and frequently does, result in the failure of efforts to bring about the desired changes in dietary practices.

Field studies conducted by INCAP in rural Indian communities in the Guatemalan highlands have disclosed similar difficulties in the introduction of scientific medical practices (ADAMS, 1952). They have also furnished examples of the specific problems encountered in nutrition education in this area, the patterns of prejudice regarding foods for infants and attitudes toward attempted changes. In this presentation findings from field studies in Santa Maria Cauqué, a Cakchiquel Indian (Mayan) village in the Guatemalan highlands, are discussed to illustrate these patterns of prejudice.

SANTA MARIA CAUQUE AND ITS FEEDING PRACTICES

The village is located at an altitude of 6,000 feet and a distance of 50 kilometers by paved road from Guatemala City, and has a population of approximately 750. Most of its families have small plots of land on which they grow corn and some vegetables. The latter are largely sold in the market in Guatemala City. It is a poor village with a relatively high morbidity and mortality from protein malnutrition in its severest form, kwashiorkor. The village is the site of an experimental distribution of milk to pregnant women, lactating mothers, infants and pre-school children.

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† The Institute of Nutrition of Central America and Panama is a co-operative Institute for the study of human nutrition, supported by the Governments of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama, and administered by the Pan American Sanitary Bureau. INCAP Scientific Publication No. I-84.

People in Santa María feed their children well not to make them healthy, but because they are healthy. A good appetite is associated with health ; however, a child is not forced to eat a food he resists since his likes and dislikes are respected. Almost any degree of sickness, however, results in the withdrawal of part of the food from his diet. Unfortunately for the child this is most often the part of his diet furnishing protein of good quality and may include nearly all of his protein of any sort. Thus, a child who has been receiving meat and milk along with beans and tortillas, will, if he develops diarrhoea, have these withdrawn from his diet, and be given instead an *atole*, or gruel, consisting almost entirely of carbohydrate. In Santa María Cauqué this may either be made from corn starch or simply consist of the cooking water from corn or beans.

Protein-rich foods are also likely to be eliminated from the diet of a child who develops any of the signs and symptoms which the mother attributes to the presence of worms. These include not only diarrhoea but also vomiting, irritability and anorexia. Meat and milk are regarded as particularly dangerous because of their effect in stimulating the worms, or " causing them to rise." Repeatedly, informants speak of foods to be *avoided* when certain symptoms are present, but the concept of some foods being especially good for children seems largely to be lacking.

Nevertheless, most cooked foods are assumed to be digestible unless specific circumstances indicate otherwise. Food is not considered a direct cause of either sickness or health ; rather there are varying degrees of tolerance of different foods. The variables involved may include age of the child, time of year, time of day, and personal idiosyncrasy as well as the state of health. Even during pregnancy and the post-partum period, foods are selected carefully not because of their positive health-giving qualities, but because they will not " hurt " the mother or the child (through the mother's milk). Thus, " harmful " foods are excluded, " harmless " ones permitted.

In time of sickness, the body must be protected from possible harm by excluding foods for which the patient is believed to have an intolerance. To the health officer, there appears to be no scientifically rational basis for determining these foods. Indeed, the mother may withhold those very foods which would bring about the most rapid recovery of her child. It has been noted time and again that the child with kwashiorkor may be deliberately deprived of meat, milk or eggs and instead given foods containing almost no protein. Under these circumstances, death is inevitable except in the rare case when the child is hospitalized in time and given the necessary protein-containing foods. The problem is further complicated by folk concepts of medical treatment. Purgatives are a popular remedy for any type of diarrhoea ; they are apt to be administered to the child with acute kwashiorkor because the parents believe this to be the correct treatment for his diarrhoea. Since kwashiorkor may be precipitated by the added protein loss from diarrhoea of infectious origin, it is particularly tragic that such a child is not only deprived of animal protein but also frequently given strong purgatives which accentuate the diarrhoea and the consequent protein loss.

A new food for infant feeding, whether it be dried skim milk or a vegetable protein mixture, will win acceptance for well children if it is liked by them and if its use is not associated with any consequences which the parents regard as unfavourable. If, on the other hand, the child does not like it, or if vomiting, diarrhoea, or pains of any sort coincide with its introduction, the new food will no longer be given. Interestingly enough, however, if these experiences are rare, there is little tendency to generalize. The mother may simply conclude that it is not good for one of her children and still continue giving it to the others. Similarly, the fact that it is supposed to have made a neighbour's child sick, will not necessarily prevent her from giving it to her own child.

While such an attitude may have some advantages for the health workers, it has led to certain difficulties in establishing a demonstration programme of milk distribution in Santa Maria Cauqué. Favourable experience in other countries or even in other Guatemalan communities was not accepted as proof that the milk would be good for the children of this village. It should be noted, however, that the educational efforts to teach the value of milk have not been systematic. Although at the present time the milk is fairly well accepted, there still are many who refuse it. There are entire families who consider that milk it not good for them, and sometimes the parents have decided that the milk is not good for one particular child in a family.

In Santa Maria Cauqué, thus far, the effort to persuade people that milk should be given to children because it improves and maintains health has been a failure. Nevertheless, the milk is accepted for other reasons. Most of those who are taking it are doing so because they like the milk and because it agrees with them, and not because of any conviction that it is good for their health or will prevent them from getting sick. In addition to a liking for the milk, the desire to co-operate with personnel responsible for its distribution, the social aspects of coming together to receive it, and the fear that treatment in the medical clinic will be denied to those refusing milk have all contributed to its acceptance.

An alternate method of introducing milk, vegetable protein mixtures or other new foods would be their promotion as medicine. The food could be recommended as good for the signs of kwashiorkor, for the symptoms attributed to worms and even for diarrhoea. We feel, however, that this would be unwise because it would limit the initial distribution to more or less ill persons and thus fail in the primary objective of prophylaxis. Furthermore, it would probably be withdrawn when the symptoms had disappeared without accomplishing the desired changes in feeding practices.

DISCUSSION

There is ample reason to believe that the attitudes and practices noted here are by no means restricted to the village of Santa Maria Cauqué. FLORES (1956) in dietary surveys in other Guatemalan villages, has noted the way in which certain items, often of good nutritive value, are withheld from some children and not from others for reasons which are inapparent or seemingly insufficient. FREEDMAN (1955) emphasized the tendency in both a coastal farm and a highland village of Guatemala to eliminate solid foods from the diet of the child with diarrhoea. She also noted the strong prejudice against meat, milk, eggs and sometimes fruit when the presence of worms is suspected. ADAMS (1952) has pointed out similar attitudes in the nearby community of Magdalena Milpas Altas, where the taking of food is associated with health and the use of herbs with sickness. WELLIN (1953) states that to the people of the Ica Valley in Peru, the most important considerations in determining whether a food item can have or has had delecterious effects include the "combination of foods, sequence in which eaten, quantities of the items consumed, time of day, age of the eater, and specific body-state enjoyed at the moment by the eater." In Santa Maria Cauqué as in Magdalena and the Valley of Ica, the acceptability of foods depends more on the individual and his condition at the time, rather than on general rules as to foods which are good or bad for health.

KELLY (1953, 1954) has indicated in her conclusions from studies in several villages in the area of La Laguna in the north of Mexico, that relatively little attention is paid to the differences among various foods when the person is healthy, but that these become very important when the person is sick. HUENEMANN (1954a, 1954b ; 1955) reports the belief in Peru that the child's stomach is not fully formed during the first year, and thus cannot handle certain foods. Nevertheless, the appropriateness of various foods and the time at which they are first offered vary greatly with each individual. Most mothers studied by her had no clear concept of those foods which were good and those which were bad for children in general, but rather seemed to depend on individual experiences. Neither was there a concept of special needs for the young child ; normally he was offered the same foods as the rest of the family after about one year.

As FOSTER (1952) has suggested, the patterns of belief in Latin America appear to have a common historical background, so it is dangerous to generalize these specific observations to other populations with a high incidence of malnutrition outside this area. We feel, however, that in addition to this historical background, many of the general attitudes here described may be functionally related to the slight degree of Westernization* involved, and thus may also be found in other parts of the world. Our results in Central America indicate that health workers cannot assume that their assessment and explanations of the value of a food will necessarily be accepted by the people. This is well illustrated for non-Latin American areas by JELLIFFE (1955) in his monograph on infant nutrition in the sub-tropics and tropics when he states :

> " Nor is it much use reasoning from what European children do or even producing visual proof of their healthiness ' because they eat this or that '. European children are European children and ' entirely different ' from Ganda, Tamil, or Malay children. ' *Dia anak Melayu, miste ada chaching* ' (' She is a Malay child, she must have worms ') — it cannot possibly have anything to do with what one does or does not do, it is just part of being a Malay. The fact that a European child eats fish and eggs, and yet does not have worms is not at all comparable."

Most people react favourably to the demonstration that a medicine or a food given as a medicine will cure an illness by readily accepting its use for this purpose. It is far more difficult, however, to introduce the concept of *food* for the prevention of illness, and exceedingly difficult to prove to the satisfaction of a primitive or peasant community, that a food or foods will actually help to maintain health. In many cases, a plan to introduce a new food about which there are no prejudices can be far more successful than a programme stressing the value of meat, milk and eggs. These latter foods are not only expensive, but are surrounded by a complex of ideas and attitudes which are difficult, if not impossible, to change in a short period of time. It is not that these attitudes will never change, but they are more likely to change slowly as a part of a general trend toward Westernization than by a direct attack on deeply rooted beliefs. This applies, of course, not only to the acceptance of food, but to the introduction of therapeutic and prophylactic techniques in general. CAUDILL (1953) summarizes a large number of studies by concluding ' that new methods of treatment will probably meet with more success than attempts to influence ideas concerning the cause of disease."

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* The terms " Western " and " Westernization," as used here refer to that type of civilization which, though having its roots in ancient Greece and Rome, developed in Western Europe during the 16th, 17th, and 18th centuries, and from there has gradually spread in its general features, to many parts of the world. It is not meant to refer to any particular country or region, but rather to a group of general cultural characteristics.

Although this suggestion is contrary to accepted nutrition education practices, it would seem easier and more effective in many cases to emphasize that there is nothing *harmful* in a new food rather than to depend on assertions of its positive value to ensure its use. Certainly, it is not always necessary for the people to understand the educator's basis for promoting a procedure which will be effective in improving their health. Vaccination against small-pox and iodization of salt for the preventive of goitre are examples of public health measures which are effective, even though they are frequently not understood by the people benefitted.

When the changing of existing attitudes toward the use of foods is sought, however, the real nature of these beliefs and attitudes should be understood by the health or nutrition educator. He must not assume that the people know nothing about foods and that it is his job to fill this void with knowledge. Actually, all cultures have a complex of positive beliefs regarding food, and failure to recognize their existence and their strength is likely to result in the failure of the project. It has been strongly recommended that a world-wide attack on the problem of protein malnutrition and other nutritional diseases be made (FAO/WHO, 1955 ; PRINCETON CONFERENCE, 1955). As part of this effort further studies of the beliefs and attitudes underlying food practices in under-developed areas should have great practical value.

SUMMARY

The beliefs and practices regarding child feeding in a small rural Guatemalan Indian village contribute to the inadequacy of the diet. The concept of special food needs for the health of young children is almost non-existent. There is a strong tendency to avoid giving them foods of animal origin because these are thought to stimulate worms, and to withdraw protein-containing foods almost entirely when diarrhoea develops for any reason. For short-term results it may be easier to introduce a new cereal product for the supplementary and mixed feeding of infants and young children than to overcome the prejudices surrounding milk, eggs, meat and similar foods. " Food " and " medicine " are completely distinct concepts in the culture studies, thus making it difficult to encourage the use of food to regain or promote health.

Similar beliefs should be looked for in communities of comparable socio-economic development in other parts of the world. Where such attitudes are apparent, it is suggested that attempts to introduce a new food will be more effective if they stress its " harmlessness " rather than its benefits. Palatability, availability and cost will then become the primary criteria for initial acceptance. It is particularly important that the health or nutrition educator attempting to change food habits understand the real nature of the beliefs underlying current feeding practices, and not assume that the people have no previous concepts regarding foods.

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KELLY (1953, 1954) has indicated in her conclusions from studies in several villages in the area of La Laguna in the north of Mexico, that relatively little attention is paid to the differences among various foods when the person is healthy, but that these become very important when the person is sick. HUENEMANN (1954a, 1954b ; 1955) reports the belief in Peru that the child's stomach is not fully formed during the first year, and thus cannot handle certain foods. Nevertheless, the appropriateness of various foods and the time at which they are first offered vary greatly with each individual. Most mothers studied by her had no clear concept of those foods which were good and those which were bad for children in general, but rather seemed to depend on individual experiences. Neither was there a concept of special needs for the young child ; normally he was offered the same foods as the rest of the family after about one year.

As FOSTER (1952) has suggested, the patterns of belief in Latin America appear to have a common historical background, so it is dangerous to generalize these specific observations to other populations with a high incidence of malnutrition outside this area. We feel, however, that in addition to this historical background, many of the general attitudes here described may be functionally related to the slight degree of Westernization* involved, and thus may also be found in other parts of the world. Our results in Central America indicate that health workers cannot assume that their assessment and explanations of the value of a food will necessarily be accepted by the people. This is well illustrated for non-Latin American areas by JELLIFFE (1955) in his monograph on infant nutrition in the sub-tropics and tropics when he states :

> " Nor is it much use reasoning from what European children do or even producing visual proof of their healthiness ' because they eat this or that '. European children are European children and ' entirely different ' from Ganda, Tamil, or Malay children. ' *Dia anak Melayu, miste ada chaching* ' (' She is a Malay child, she must have worms ') — it cannot possibly have anything to do with what one does or does not do, it is just part of being a Malay. The fact that a European child eats fish and eggs, and yet does not have worms is not at all comparable."

Most people react favourably to the demonstration that a medicine or a food given as a medicine will cure an illness by readily accepting its use for this purpose. It is far more difficult, however, to introduce the concept of *food* for the prevention of illness, and exceedingly difficult to prove to the satisfaction of a primitive or peasant community, that a food or foods will actually help to maintain health. In many cases, a plan to introduce a new food about which there are no prejudices can be far more successful than a programme stressing the value of meat, milk and eggs. These latter foods are not only expensive, but are surrounded by a complex of ideas and attitudes which are difficult, if not impossible, to change in a short period of time. It is not that these attitudes will never change, but they are more likely to change slowly as a part of a general trend toward Westernization than by a direct attack on deeply rooted beliefs. This applies, of course, not only to the acceptance of food, but to the introduction of therapeutic and prophylactic techniques in general. CAUDILL (1953) summarizes a large number of studies by concluding ' that new methods of treatment will probably meet with more success than attempts to influence ideas concerning the cause of disease."

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EXCERPT

RELATIONSHIP OF CERTAIN SEROLOGICAL STRAINS OF E. COLI TO INFANTILE GASTRO-ENTERITIS IN JAMAICA

(B. M. CLARK AND L. S. GRANT. *West Ind. med. J.*, 1957, **6**, 108)

In 1956 two serological strains of *E. coli* which are known to be associated with infantile gastro-enteritis, were isolated from eleven patients. With the exception of one case in 1950 (GRANT), this is the first series of cases diagnosed in Jamaica. Ten of the eleven patients had symptoms of gastro-enteritis. None of the patients, with the exception of the one asymptomatic case, had been entirely breast fed. Seven of the ten cases of gastro-enteritis were within the first four weeks of life ; of these three proved fatal. One case of asymptomatic double infection has been discovered. Biochemical tests carried out on the strains of pathogenic *E. coli* isolated conformed with the normal pattern for organisms of this group.

THE EFFECT OF AN EQUATORIAL CLIMATE ON BIRTH WEIGHT AND SUBSEQUENT WEIGHT OF INFANTS

by

JEAN MILLIS*

(Department of Social Medicine and Public Health, University of Malaya, Singapore)

There are conflicting reports in the literature regarding variation in birth weight of infants at different times of the year. MURRAY (1924), TOVERUD (1933), BIVINGS (1934), PERLSTEIN and LEVINSON (1937), PETERSEN and MAYNE (1943), and CHEN-CHIA LEE (1948) claimed that infants born in the warmer months were heavier. These findings were not substantiated by BAKWIN and BAKWIN (1929) or by MICHELSON (1934), and CLEMENTS (1933) found variations which were within the probable error of the standard mean for the year.

Singapore has an equatorial climate with no noticeable seasonal change and little alteration in temperature or humidity throughout the year. The mean annual temperature for 1945-55 was 80.9°F and a mean daily maximum of 87.3°F and a mean daily minimum of 74.5°F.

This study was undertaken to show if the mean birth weights of infants varied in the different months during the year and if they differed from the means of infants of the same ethnic groups who were born in countries with cold or temperate climates. Data were also collected to demonstrate if Caucasian infants exhibit a satisfactory rate of growth in an equatorial climate.

EFFECT ON BIRTH WEIGHT

Description of study groups. The infants were born in the Kandang Kerbau maternity hospital where the mothers had been admitted to the third class wards and the families belonged to the lower income groups of the community. All infants who were singletons and who had received the medical grading of physically mature, were included. During the year 1951, there were 4,935 males and 4,550 females whose parents were of Chinese ancestry and, during the years 1950 and 1951, there were 761 males and 704 females whose parents had immigrated from the South of India.

Collection of data. The hospital staff used an infant beam balance to weigh the naked infants in the labour ward within a few minutes of birth. The birth weights were recorded to the nearest ounce.

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* I wish to record my thanks to the staff of Néstle's Products (Malaya) Ltd., and in particular Mrs. A. G. Faulkner, for their assistance and co-operation in making available the records of Caucasian infants.

Results and discussion. Table I gives the mean birth weights of infants in different months of the year and, although the number of births varied, the average birth weight was not significantly different from one month to another or from the mean for the year.

TABLE I. Mean birth weights of infants in different months in the year.

Time of year	*Mean birth weight (1lb)*			
	Chinese infants		South Indian infants	
	Male	Female	Male	Female
January	6.95	6.73	6.51	6.34
February	6.98	6.63	6.48	6.29
March	6.93	6.73	6.55	6.36
April	6.86	6.66	6.78	6.35
May	6.94	6.65	6.36	6.36
June	6.80	6.71	6.25	6.44
July	6.91	6.70	6.47	6.22
August	6.90	6.70	6.36	6.41
September	6.84	6.74	6.47	6.13
October	6.96	6.76	6.55	6.47
November	6.93	6.70	6.40	6.35
December	6.91	6.68	6.61	6.57
Total	6.91	6.71	6.48	6.35
Standard deviation	±0.88	±0.84	±0.84	±0.76

Differences in birth weight at different times of the year have only been found in countries with marked climatic changes. TOVERUD (1933) made the suggestion that it was probably due to seasonal variations in food supplies. This comment received support from the observations of HUSSLEIN (1947), who found periodicity in birth weights of infants in Austria only in the years in which relative food shortages occurred.

Economic status of the family has been shown to influence the birth weight of the offspring (MILLIS 1953, 1955), and comparisons should not be made between infants without taking into account the economic and social environment. The differences between the mean birth weights of Chinese, Indian and Caucasian infants in Singapore (Table II) are highly significant. However, the dissimilarity can be largely attributed to environment. In an investigation of higher income families, MILLIS (1953) found the mean birth weights were 6.99 lb. for Chinese males and 6.88 lb. for females ; 6.82 lb. for Indian males and 6.83 lb. for females and the differences between the means for males and between the mean for females were not significant.

Therefore, in each ethnic group, as far as possible, records of infants of comparable economic and social environment have been selected and Table II compares the mean birth weights of infants born in an equatorial climate with those of infants of the same ethnic groups born in tropical, temperate or cold climates. The intra-group differences are small and it is concluded that climate *per se* has not influenced birth weight.

TABLE II. Mean birth weights of infants in different countries.

Ethnic Group	Country	Mean Birth weight (lb.)		Reference
		Males	Females	
Chinese	China	6.80	6.58	Chen-Chia Lee (1948)
	China	6.89	6.57	Lee (1930)
	Hongkong	6.77	6.52	Uttley (1940)
	Indonesia	6.87	6.72	Njo-Tiong-Tjiat (1951)
	Singapore	6.91	6.71	Millis
Indian	Singapore	6.48	6.35	Millis
	South Africa	6.59	6.32	Salber & Bradshaw (1951)
Caucasian	America	7.50	7.44	Burke, Harding & Stuart (1943)
	England	7.57	7.31	McKeown & Gibson (1951)
		7.62	7.37	Parfit (1951)
	Indonesia	7.69	7.42	Njo-Tiong-Tjiat (1951)
	Singapore	7.56	7.38	Millis
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THE EFFECT ON SUBSEQUENT WEIGHT

Description of study group. The Caucasian infants were mature singletons without congenital deformities, who were born in Singapore, but whose parents had immigrated mostly from United Kingdom and the Dominions. The parents belonged to the middle and upper income levels of the community. There were 60 male and 76 female infants.

Collection of data. The data on weights of Caucasian infants were collected by a trained infant welfare nursing sister who visited the infants regularly in the homes and at each visit, the weight and age were recorded and the mother was given advice on the feeding and care of the infant. The weight of the naked infant was obtained by the use of an infant beam balance. There were 480 observations of males and 598 of females in the first nine months after birth.

Method of analysis. The records of each sex were treated separately as it has been shown that males and females were significantly different in birth weight and in the subsequent rate of growth (MILLIS and TYE, *in press*). The weight measurements were grouped on the central age system, whereby a record of an infant between the age of 14 and 41 days was included in the first four-week period, between the age of 42 and 69 days in the second four-week period and so on.

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Results and discussion. The mean weights in ounces at each age interval are presented in Table III together with the means for Australian infants (CLEMENTS, 1933) and for infants in Edinburgh (THOMSON, 1955). It can be seen that the progress of the Caucasian infants was not adversely affected by the climate of Singapore as the increase in body mass during the first 36 weeks was comparable with that of infants in cold and in temperate climates.

TABLE III. Weights of Caucasian infants at different ages and in different countries.

Age in weeks	Mean weights in ounces of Caucasian infants.					
	Males			Females		
	Singapore	Australia*	Scotland†	Singapore	Australia*	Scotland†
0	121	(130)‡		118	(126)‡	
4	148	149	136	140	144	131
8	179	176	168	167	170	161
12	210	199	200	192	193	187
16	235	223	223	217	214	212
20	260	242	246	237	235	231
24	275	258	268	257	252	251
28	288	275	287	268	267	269
32	301	289	293	281	281	286
36	306	302	309	294	294	299

* Clements (1933). † Thomson (1955).

‡ Values of 130 and 126 ounces for the birth weights respectively of male and female Australian infants born in maternity hospitals, Sydney depart so seriously for other published values for Australian infants as to make it inadvisable to include them in a table such as this without confirmation.

SUMMARY AND CONCLUSIONS

The birth weights of 4,935 male and 4,550 female Chinese infants and of 761 male and 704 female Indian infants have been examined. The variation in the average birth weights in different months was not significant.

A comparison was made between the mean birth weights of infants of the same ethnic groups and similar economic circumstances who were born in equatorial, tropical, temperate or cold climates. The intra-group differences are small compared with inter-group differences The disparity between ethnic groups can be largely attributed to differences in economic and social environment It was concluded that climate *per se* had not influenced birth weight.

A growth study of 60 male and 76 female Caucasian infants born in Singapore was undertaken during the first 36 weeks of life. The increase in weight was similar to that reported for infants in Australia and in Scotland. It was concluded that an equatorial climate does not affect adversely the increase in body mass during the first 36 weeks.

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EXCERPT

TREATMENT OF SEVERE PROTEIN DEFICIENCY IN CHILDREN (KWASHIORKOR)

(M. BEHAIR, F. VITERI AND N. S. SCRIMSHAW. *Amer. J. Clin. Nutr.*, 1957, 5, 606.)

Detailed suggestions for the treatment of children with severe protein malnutrition (kwashiorkor) are given. These include attention to the fluid and electrolyte imbalances which are likely to characterize the acute case due to secondary complications and instructions for beginning treatment with frequent feedings of milk diluted to half strength. One to 2 g. of protein and 30 to 60 cal. per kg. are given in the first 24 hours and the strength and amount of milk increased to provide 5 g. of protein and 100 cal. per kg. by the end of the first week. Bananas, fruit juice, meat, eggs, vegetables and cereals are gradually added to give a diet throughout most of the recovery period containing 5 to 7 g. of protein and 130 to 150 cal. Penicillin is given routinely for the first eight to ten days and supplementary iron therapy is started after one week has elapsed. Vitamin A is given when serious ocular lesions are present and whole blood transfusion may be necessary in the rare case of collapse, shock, or severe anaemia : no other vitamins or minerals and no special enzyme or lipotropic preparations are indicated. The importance of protection from infection and the need for sympathetic and understanding care are stressed. The cost of hospitalization of kwashiorkor cases can be drastically reduced by eliminating the use of costly proprietary preparations and by greatly shortening the hospital stay, through close attention to the principles of treatment described.

MATERNAL AND CHILD HEALTH SERVICES IN SOUTH-EAST ASIA
(VII) CRITICAL DISCUSSION

by

P. ROBINSON

(W.H.O. Adviser in Maternal and Child Health, Regional Office for S.E. Asia, New Delhi)

In the six recent short reviews of maternal and child health services in countries in South-East Asia, an attempt was made to describe briefly the situation in India (ROBINSON, 1956a), Afghanistan (ROBINSON, 1956b), Burma (ROBINSON, 1956c), Indonesia (ROBINSON, 1957), Thailand (METTROP and ROBINSON, 1957) and Ceylon (KARUNARATNE et al., 1957).

However, even since those articles were written, between one and two years ago, considerable changes have taken place and in the Addendum (ROBINSON, 1957) we have tried to bring the information up-to-date. The necessity to write such an Addendum is, we believe, in itself proof of the rapid pace of development of health services in South-East Asia.

In the present paper we propose to discuss some of the major aspects of maternal and child health work in the region.

(1) *Administration*

There are no special departments as yet on a governmental level for MCH in Afghanisstan or Ceylon. In Burma and Thailand, the officers in charge of MCH are designated as the administrative heads of the service ; while, in India and Indonesia,those responsible for MCH are classified as " advisers." However, there appears to be no difference between the scope and degree of authority of the " directors " and " advisers." They are all in principle concerned with MCH centres and domiciliary midwifery to the exclusion of curative child care activities and institutional midwifery. In Burma and Indonesia, school health comes under the MCH department.

In most countries of this region, efforts are being made to provide administrative supervision in MCH also on provincial or district levels. Outside India, this supervision is not planned to be in the hands of medical officers, but of public health nurses — as in Burma, or " supervising midwives " — as in Indonesia, Thailand or Ceylon.

On the other hand, efforts to incorporate MCH work in community health services have resulted in reduction of direct administrative authority of MCH officers. This is not always welcomed by senior national workers in the field, who feel that maternal and child health services are still in the pioneering stage and that it is necessary to continue a separate administration in order to prevent the, still not firmly established, promotional and preventive activities from being swallowed up by the more spectacular curative services.

(2) *MCH Centres*

The main object of the centres in South-East Asia is understood to be the rendering of ante-natal, natal and post-natal care and the supervision of well infants and toddlers. The child care aspect is usually less emphasized and it is not uncommon for centres to work on the principle that a well child needs no help and a sick child belongs elsewhere. However, as a rule, the child welfare sessions are for all practical purposes sick child clinics, in tacit recognition of the fact that there are very few children attending the centres who may be classified as well.

It is easy to trace the origin of practices and procedures in the MCH centres of India, Burma or Ceylon to trends in the United Kingdom in the period between the two world wars. The techniques in Indonesia are influenced by the Dutch, while in the countries which were not under colonial rule — Afghanistan and Thailand — services are of more recent origin, mainly developed with the assistance of foreign experts, and the practices are usually based on those common in the country of origin of the expert.

In this, as in any other field, there is an energetic and ambitious drive in this region to catch up as quickly as possible with the more fortunate countries. Consequently it is only natural that patterns of service common in the west are often being copied without much discrimination. In the enthusiasm of providing much needed services for the vulnerable groups of the population, little consideration has been given until recently to the fact that the MCH centre in the west was developed in order to supplement existing, more or less adequate, curative services, while in this region such services are usually poorly developed. A WHO technical report (1957) makes this point clear by stating "(the group) deprecated the separation of preventive and curative services, particularly in countries where illness is rampant and medical care facilities inadequate."

It is often forgotten, not least by foreign experts, that an MCH centre was never meant to work independently, but must use higher level health services for consultation and follow-up of discovered pathological conditions. While the routines of examinations follow the western pattern, facilities to secure necessary action are seldom available, and, if available, channels of referral do not exist.

Provision of maternal and child health services in combined units may partly be responsible for the relative neglect of child care. Male doctors are not normally acceptable for maternal work and are therefore not employed in MCH centres, while women doctors usually practise or specialise in obstetrics ; when given charge of MCH centres, the women doctors naturally concentrate on the subject in which they are trained — maternal care — and pay only limited attention to child care.

(3) *School Health Services*

There is the usual divergence of opinion in this region as to whether school health services should be under the department of health or under the department of education. This is perhaps an academic problem in countries with highly developed services, and indeed, special merits have been claimed by protagonists of both approaches. However, it would seem that in South-East Asia, which is short of trained workers in all fields, it is uneconomical to set up separate school health services under authorities other than of the health administration. Also it would appear that the major value of school health services at this stage is in establishing contact with the families and in using it as a spearhead for developing community health services.

In general, medical examinations, school meals and efforts to improve school sanitation are among the major activities at present. Recent trends are in the direction of increase in health education activities and use of the teachers for this purpose. The situation in the different countries is summarized in Table I.

(4) *Health Centres*

There is a strong tendency in all countries of the region to create health centres, where maternal and child care constitutes an integral part of the service.

TABLE I. Synopsis of school health activities in South-East Asia.

India	As a rule under supervision of health authorities, but not MCH departments. The main concentration at present is on periodic examinations. School meals, where given, are reserved for the "undernourished" usually calculated at about 20% of the students. A special effort is made under the Second Five-Year Plan to provide sanitation facilities to selected schools in rural areas.
Afghanistan	A few schools in Kabul are visited by doctors. Plans for a more comprehensive service are under consideration.
Burma	On governmental level, school health is under the MCH Division and in most towns efforts to integrate these two branches of service are being made. In rural areas, it is theoretically part of the health centre activities, but in practice little is done so far.
Indonesia	School health is under the department of MCH. Services are supervised either by visiting part-time doctors or nurses. Usually a team of nurses and auxiliaries visit each school once a year for a regular health examination of the children.
Thailand	Under the Ministry of Health there is a separate division for school health which runs directly a number of clinics in the capital. In the provinces schools are served by mobile teams, each consisting of one doctor, two nurses and two dental hygienists.
Ceylon	There is no separate school health organization and the work is done as a part of the government's health service. All children up to 5th standard receive a mid-day meal.

In India, the Second Five-Year Plan provides for a 50 per cent. coverage of the rural population with so called "primary health centres" by March, 1961. Existing MCH centres or maternity services will be integrated in the "primary health centres."

In Afghanistan, while ante-natal and occasionally also child welfare clinics are being established in towns on a small scale, health services for rural areas, where such are being developed, are also on the pattern of community health centres.

In Burma, the development has been slow but the principle of a comprehensive health centre is strictly adhered to. Only in towns are MCH centres continuing to function as such.

In Indonesia, the drive to establish health centres has just been launched. The establishment of additional MCH centres still continues, but the ultimate aim is to incorporate eventually all existing and future MCH centres in integrated health centres.

In Thailand, there are no separate MCH centres except in the capital. Plans are being finalized to cover a large proportion of the country with health centres.

In Ceylon, existing services are being integrated all over the country into "peripheral health units."

Plans for development of health services in all countries of the region are strongly influenced by modern trends in medical philosophy in the west and the implementation is assisted by foreign aid. A major limiting factor is shortage of personnel and unattractive conditions of service.

What appears to be a major handicap is the present isolation of the rural health services. In India, during the First-Five Year Plan, health centres in community development areas were not even administratively under the department of health. This is being changed now, and during the Second Five-Year Plan, a number of hospitals and laboratories are being developed for the specific purpose of providing referral service for rural health centres. In other countries no such effort exists for the time being.

TABLE II. Health Centres in South-East Asian countries.

Country	Coverage	Main Centre.			Subsidiary Centre.		
		Designation	Population	Staff	Designation	Population	Staff
India	Up to 50% planned for 1961	Primary Health Centre	60,000	1 M.O. 1 Health Visitor or public health oriented nurse 1 midwife 1 sanitarian	Sub-Centre	15,000	1 midwife
Afghanistan	Experimental stage	Health Centre	Not yet determined	Not yet determined	Nil	Nil	Nil
Burma	20% in 1959	Health Centre	10,000	1 Health Asst. 1 Health Visitor 5 Midwives 1 Sanitarian 1 Vaccinator	Nil	Nil	Nil
Indonesia	Experimental stage	District Health Centre	100,000	Not yet determined	Sub-district Health Centre	25,000	Not yet determined
Thailand	Organizational stage	First Class Health Centre	50,000	1 M.O. 1 Nurse 1 Midwife 1 Sanitarian	Second Class Health Centre	5,000	1 Sanitarian 1 Midwife
Ceylon	Nearing full coverage	Peripheral Unit	Not yet determined	1 M.O. " Apothecary" 1 Nurse 1 Midwife 1 Sanitary Inspector	Nil	Nil	Nil

Shortage of funds is usually given as a reason for this unsatisfactory state of affairs. But there also appears to be a diversity of interests of different departments and an apparent lack of awareness that peripheral health services cannot function adequately without support on a higher level, both in the professional as well as in the administrative field.

(5) *Midwifery Services*

In South-East Asia, as in most parts of the world, town people more and more tend to use institutional midwifery services. Although more expensive, it is usually considered advantageous, as it is difficult to conduct a safe delivery in the crowded and unhygienic homes of these countries. Unfortunately, the preference for institutional deliveries is shown by women of the middle and upper classes, who have adequate facilities in their homes, while precisely those who would benefit from institutions often refuse to take advantage of those.

The great majority of all women in South-East Asia is still delivered by unskilled professional, semi-professional, or amateur birth attendants. The only exception is Ceylon, where only about 10 per cent. are estimated to be delivered by the *gode vinappa ammas.*

The situation in India, where the term *dai* covers a wide variety of birth attendants and, as their number exceeds a million, merits some additional discussion.

The main categories of *dais* in India are :

The hereditary. In many parts of the country this is a sub-caste, and the daughter, or a daughter-in-law, of the *dai* invariably takes over from the older woman on her death or " retirement." They usually rank low in the social ladder.

In this category, there is often a generation-old relationship between the *dai's* family and a number of families in the village, and she is not paid for her actual work, but gets a certain share of the crop or some other compensation in kind.

The " casual." In States like Orissa, Assam and among some hill tribes in other parts of India, it is usually either a member of the joint family or a lady of high social standing —as, for instance, the wife of the village headman—who attends to births. Where this is the practice, *dais* are held in high esteem and are consulted on various health and family matters. They receive no direct compensation, but may accept gifts.

The trained. This is a confusing term applied both to hereditary *dais* who have undergone some sort of training and to girls or women who were specifically recruited for training as *dais.* The latter category is often referred to as nurse-*dais.* The training of such non-hereditary *dais* may take from 6 months to two years. The short-term training is mostly carried out in MCH centres, and the trainees are often widows or abandoned women—thus there is combination of social rehabilitation with training of " professional " personnel. The long term training is given in maternity hospitals to young and mostly literate girls.

Official attitudes to *dais* in India vary considerably. Some believe in the possibility of implementing the recommendations of the Bhore Committee Report to replace all *dais* by trained midwives. This is challenged on the grounds that even if it were possible to find a sufficient number of suitably educated girls willing to be trained as midwives (the Bhore Committee recommends training of 650,000 midwives, one for each village), it would still not be a simple matter to make the population accept this new category, especially if the trained midwife is relatively young and has no children. There is, in addition, little doubt, that the newly trained midwives are reluctant to live in villages.

Midwives are not a full substitute for *dais*, who often render additional services, such as cleaning the house, washing of clothes and cooking for the family while the mother is in labour.

The present attitude of the Central Government is that training of indigenous *dais* and placing them under supervision rather than replacing them by midwives, constitutes a more realistic immediate solution. Such training has gone on for a long time, but the success is not very obvious. There are major difficulties. To start with, the *dais* do not come forward readily for training and this for a number of reasons : very few of them believe that there is anything they do not know, and perhaps more important, they are apprehensive that, by getting trained and registered, they will become subject to government control and will be considered by the population as government servants and thus the people will refuse to pay them. Being put under supervision of relatively young girls may cause loss of their prestige and by submitting to supervision they would admit the superiority of those midwives. If one adds to this that the young trained midwives are city-bred girls who have little understanding of the complicated conditions and personal relationships in an Indian village — "supervision" becomes a real problem.

"Nurse-*dais*" accept supervision more readily and they are therefore often more popular. But, being considered a trained category, many are given responsibilities far beyond simple birth attendance and, in several states of India, such a *dai* is often the only maternal and child health worker in a health centre.

The problems in other countries of the region are in principle similar to those of India, except that they are less acute. In Afghanistan, *dais* are not recognised officially, but are still in considerable demand. The *let-te* of Burma, the *moh-tam-yae* of Thailand (who are sometimes men) and the *dukun* of Indonesia appear to be more receptive and easier to fit into an organized service than the Indian *dai*. In these countries, the population is also less opposed to the substitution of traditional birth attendants by trained midwives.

(6) *Pediatrics*

Separate children's hospitals or independent departments do not exist in South-East Asia outside teaching institutions. In-and out-patients' care suffers invariably from overcrowding. The number of qualified pediatricians is very small and the general practitioners are poorly trained in pediatrics. If one considers, in addition, the high child morbidity and mortality rates, it becomes obvious that the situation calls for a concentrated major effort.

It is important, no doubt, to plan for a better future, but thought must also be given to optimal use of available resources. Least of all can these countries afford to repeat the tortuous development of pediatrics in the west step-by-step. Nor is this necessary, seeing that some practices, discarded a few decades ago, have been reinstated.

It would appear that decentralization of child care and integration of preventive and curative activities might ensure better use of the limited resources. The pediatricians, instead of concentrating on a small number of gravely ill children, could devote most of their time for consultation and guidance in as many clinics and "welfare centres" as possible.

A small scale experiment in this direction has already been initiated in Hyderabad last year, and a more extensive and ambitious one is under preparation in Madras.

Education of the public in the optimal use of cheap foods and in essentials of sanitation will have to constitute an integral part of the activities of any unit — preventive, curative or combined — which deals with children. Last, but not least, much more use should be made of the potentialities of health education during the periods of hospitalization. This is facilitated by the practice of allowing mothers to stay with their children, which is almost universal in S.E. Asia. The only exceptions are Burma, where following advice of foreign experts, mothers are as a rule debarred from staying in the hospital. The interest in optimal use of mothers on the wards in India, where mothers are excluded from a few units only is growing as witnessed by the discussion on this subject at the Eighth All-India Pediatric Conference in Vellore (1956).

One would assume that with the major problems of physical health still unsolved little interest would be shown in child psychology. This is not the case, even if there are only a few child guidance clinics in existence in this region and practically no child psychologists. The largest single effort in this field in South-East Asia is the psychological child care centre in Bangkok, Thailand.

It seems reasonable to assume that the present rapid economic development in the countries of the,region, urbanization and industrialization will eventually create problems similar to those in the west and western methods of psychological care may become increasingly suitable. For the present, however, there appears to be a radical difference between the rationale of application of western methods of somatic medicine and those of psychological medicine.

The major problems of physical health in South-East Asia now are essentially the same as the problems with which medicine was confronted in more fortunate countries only some decades ago, namely disturbances resulting from poor nutrition, lack of sanitation and a low level of living in general. Thanks to advances in medical science and to international co-operation and assistance in economic fields, there appears to be good reasons to expect that the countries in this region will be able to solve those problems effectively through application of modern methods. This is not the case, it seems, in the field of psychology. Tradition and customs, social and family relationships are as a rule comparable to those which were prevalent in the western world long before the advent of modern psychology, and it is questionable whether the usual psychological methods are applicable here.

The following few observations are based mainly on experience of a WHO psychologist who worked in Thailand for the past two years (STEPAN, 1957).

A child under treatment in a special clinic is invariably advised from one or several additional sources, be it another doctor, an indigenous healer or a grandmother. As a result, it is difficult or impossible to build up the important stage of transference. The phase of negative transference and aggression is even more difficult to achieve in children who are brought up to accept adult authority and not to rebel.

Identification with one person — the therapist — is seldom possible, as children grow up to accept many authorities in a joint family. One wonders whether it is at all advisable in this part of the world to encourage feeling of independence in child patients, considering the adverse effect it may have on family relations. The popular saying that there are no problem children, only problem parents has perhaps a deeper significance in the east than the west.

Theoretical considerations and practical experience seem to indicate that suggestive treatment under the present circumstances might be more successful than analytical.

Lack of standards gravely handicaps research in psychological problems of childhood in this part of the world.

Pediatric education has not received a great deal of attention recently outside India, where pediatrics is still fighting for recognition as a separate subject. In Afghanistan, Ceylon, Thailand and Indonesia, though the period of teaching devoted to pediatrics is very short, the subject is recognised as a speciality and the departments are independent. In many medical colleges in India, pediatric services form a part of the medical department and pediatrics is taught by the professor of medicine. It would be fair to state that in India as well as in Burma, preventive pediatrics is handled mainly by obstetricians, while the clinical side of the subject is the domain of physicians.

However, in India pediatrics is on the ascent. Whereas out of the existing 34 medical colleges in 1955 only two had professors of pediatrics and not a single other pediatrician had a designation higher than lecturer, there are at present four full professors, one associate professor and six readers.

The Medical Education Conference held in November 1955 discussed the question of Pediatric Education in India and made the following recommendations :

(1) " In view of the vital importance of pediatrics in over-all programme of undergraduate education and in view of the recent development in the subject, the Conference recommended that special departments of pediatrics should be established in the medical colleges, and

(2) " A period of not less than three months should be devoted to its study."

The Government of India is consequently preparing a scheme during the Second-Five Year Plan for the upgrading of two departments for postgraduate training in pediatrics, and assisting five additional departments for better undergraduate teaching.

Promotional and preventive child care is also becoming a part of the pediatric service and teaching in several medical colleges in India. Outside India, interest in co-ordination of preventive and curative child care activities is also shown in a few places, as in Semarang (Indonesia) and in a pilot project in Kalutara (Ceylon) which, however, is not connected with a teaching institution. Otherwise strict separation of the two aspects of pediatrics is still the rule.

Postgraduate pediatric teaching is given in a number of medical colleges in India and a course has recently been introduced for the first time in Colombo (Ceylon). No efforts in this direction are as yet noticeable in the other countries of the region. The " postgraduate training " is for a " Diploma in Child Health " on the British pattern, and takes one year. The teaching is not necessarily given in medical colleges. Some hospitals or institutions may be affiliated to universities and recognised as " post-graduate colleges."

It is difficult to visualize the future of the holders of a " DCH." They obviously cannot be considered, as in the past, as fully specialized pediatricians and cannot qualify for senior pediatric or teaching posts. On the other hand, one would not expect such doctors to accept service in peripheral MCH centres, nor is it likely that they will be acceptable for such posts, especially the males.

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TRADITIONAL SYSTEMS OF CHILD CARE

(Some Implications in the West Pacific Region)

by

ANNE BURGESS

" It was time then, the Old Man thought, for me to start learning about native customs. He told me to take lessons first of all from the *kabbure* of Taaiang village . . . .

" A little golden girl of seven, naked save for a wreath of white flowers on her glossy head, invited me to mount upon the raised floor of the *mwenga.* As she spread a fine guest mat for me to sit upon, she told me her name was Tebutinnang — Movement-of-Clouds. Seated cross-legged on another mat, she explained with gravity that her grandfather had charged her to entertain me with conversation, should I arrive before his return from fishing. He would not be very long now ; would I like to drink a coconut while she went on entertaining ? When I said yes, please, she climbed down from the floor, brought in a nut which she had opened under the trees outside with a cut-lass knife almost as long as herself, sat down again and offered it to me cupped in both hands, at arms length, with her head a little bowed. ' You shall be blessed,' she murmured as I took it. I did say ' Thank you ' in reply, but even that was wrong ; I should have returned her blessing word for word, and, after that, I should have returned the nut also, for her to take the first sip of courtesy ; and at last, when I had received it back, I should have said ' Blessings and peace ' before beginning to drink the milk. All I did — woe is me — was to take it, swig it off, and hand it back one-handed, empty, with another careless ' Thank you.'

' She did not rise and run off with it as I had expected, but sat on instead with both arms clasping the nut to her little chest, examining me over the top of it. ' Alas,' she said at last in a shocked whisper, ' Alas ! Is that the manners of a young chief of Matang ? '

" She told me one by one of the sins I have confessed, and I hung my head in shame, but that was not yet the full tale. My final discourtesy had been the crudest of all. In handing back the empty nut, I had omitted to belch aloud. ' How could I know when you did not belch,' she said, ' How *could* I know that my food was sweet to you ? See, this is how you should have done it ! '

" She held the nut towards me with both hands, her earnest eyes fixed on mine, and gave vent to a belch so resonant that it seemed to shake her elfin form from stem to stern. ' That,' she finished, ' is *our* idea of good manners,' and wept for the pity of it." (GRIMBLE, 1952).

For the health worker to " start learning about native customs " in the field of child care, and particularly with regard to the child of 1 to 6 years, is difficult.

Present-day avidity for action has replaced the years of apprenticeship formerly considered necessary for any would-be administrator, by a scanty period of briefing or " orientation," often carried out by others who have no personal experience of the local conditions. Once in the field, however much one wants to do so, there is little time to " stand and stare," and to ponder long enough to develop the insight needed for the correct interpretation of one's observations. And the combination of action and observation is self-defeating, for the one influences and distorts the other (FREEDMAN, 1954).

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Nor is consultation of the literature always easy. Medical libraries are just beginning to house the anthropological records to which one instinctively turns for help, and not all anthropological records contain the details of child rearing practices which we need, though there has been some brilliant leadership in this field in recent years.

In the search for knowledge about the child of 1 to 6 years in this region, the first problem might be the definition of the kind of " years " — Mohammedan, Christian or Chinese, for all systems of reckoning are to be found in different areas. But this is unimportant compared with the main difficulty. Except in those countries where the native customs include that of beginning the child's formal education at six years of age the child of this particular age is apparently an unknown entity, unrecognised and undescribed. In many of the other cultures chronological age is unimportant and its reckoning apt to be haphazard. Where life is monotonous and the birth of a child an unremarkable and frequent occurrence, " the actual age in months and years is no concern. In fact it is very difficult for the average mother to count back through the number of gardens she has planted, in order to tell you whether her child was born three even or four years ago." (DU BOIS, 1944).

In such circumstances it is not surprising to find that the stages of a child's growth are unrecognised by changes in its behaviour — for example, the unborn child ; " infancy— from birth to walking ; early childhood — from walking to wearing a loin cloth ; late childhood — from loin cloth to thoughts of marriage " (DU BOIS, 1944). The divisions recognised are social rather than physiological and do not correspond to any fixed chronological pattern. " The case of adolescence is particularly interesting . . . . The most casual survey of the ways in which different societies have handled adolescence makes one fact inescapable ; even in those cultures which have made most of the trait, the age upon which they focus their attention varies over a great range of years. At the outset, therefore, it is clear that the so-called puberty institutions are a misnomer if we continue to think in terms of biological puberty. The puberty they recognise is social, and the ceremonies are a recognition in some fashion or other of the child's new status of adulthood " (BENEDICT, 1935).

This same lack of correspondence between cultural institutions and the physiological stages of child development is found also where Western customs have spread. The culturally determined division 1 to 6 years is not in accord with the recognised growth periods — the first great spurt of intra-uterine development, or the second slower one from birth to seven years. Nor is the third milestone — the change from primary to secondary schooling — any more happily placed, except for those fortunate children who begin their " Upper school " at 13+ instead of the more usual 11+. It is difficult to find an adequate reason for such arbitrary arrangements in a culture which has developed the means of recognising the physiological stages, " without the clue that in our civilisation at large, man's paramount aim is to amass private possessions and multiply occasions for display . . . Our attitudes towards our children are (equally) evidences of this cultural goal. Our children are not individuals whose rights and tastes are casually respected from infancy, as they are in some primitive societies, but special responsibilities, like our possessions, to which we succumb or in which we glory as the case may be. They are fundamentally extensions of our own egos and give a special opportunity for the display of authority. The pattern is not inherent in the parent-child situation, as we so glibly assume. It is impressed upon the situation by the major drives of our culture, and it is only one of the occasions in which we follow our traditional obsessions." (BENEDICT).

It is impossible here to describe and discuss all the varying " traditional obsessions " found in the numerous cultures in this Region, and their effect on the parent-child situation and the health and welfare of the child. MARGARET MEAD and others have pointed out how every detail of the child's experience from the earliest moment influences and moulds his character and his attitude to the world around him, and equips or fails to equip him to survive in his adult world. A few examples* must suffice.

" The Arapesh (New Guinea) treat a baby as a soft vulnerable precious little object to be protected, fed and cherished. Not only the mother but the father also must play this over-all protective role. After birth the father abstains from work and sleeps beside the mother, and he must abstain from intercourse while the child is young, even with his other wife . . . . Through the long protected infancy, during which children are carried slung in bags from their mothers' foreheads or high on their fathers shoulders, up and down the steep mountain trails and are never asked to perform tasks which are difficult or exacting, their whole interest is focussed on the mouth . . . . The Arapesh child, male and female, continues to take in receptively, passively, what is offered it — and to fly into tempers if food is ever refused, as it sometimes may be from necessity . . . . When the usual pattern of marriage is followed, in which the husband as a boy of twelve or fourteen begins to feed his betrothed wife, himself playing a role that his mother — and his father — have played to him — and the marriage is not interrupted, the woman is in a psychological position that is the perfect development of her childhood experience — passive, dependent, cherished, But what happens to the Arapesh male ? . . . . They engage very little in warfare, they permit themselves to be blackmailed and bullied and intimidated and bribed by their more aggressive neighbours ; they admire so deeply the artistic products of others that they have developed practically no art of their own. When they hunt they set traps and wait until the animal falls in, or else they ' walk about in the bush looking for game ' and quarrels between the hunting partners come over who first caught sight of the animals . . It is a society that makes it much more difficult to be a male, especially in all those assertive, creative, productive aspects of life on which the super-structure of a civilisation depends."

In contrast, " The Mundugumor (New Guinea) women actively dislike child-bearing and they dislike children. Children are carried in harsh opaque baskets that scratch the skin, later high on the mothers' shoulders well away from the breast. Mothers nurse their children standing up, pushing them away as soon as they become the least bit satisfied. The occasional adopted child is kept sharply hungry, so as to suck vigorously on a woman's breast until the milk comes in. Here we find a character developing that stresses angry eager avidity. In later life, love-making is conducted like the first round of a prize fight, and biting and scratching are important parts of fore-play. When the Mundugumor captured an enemy they ate him, and laughed as they told about it afterwards."

And finally, " The character type in which the most emphasised communication between parent and child has been an emphasis on elimination is one that occurs frequently in our own society. We find it writ large among the Manus tribe of the Admiralty Islands, a group of efficient puritans, where women never swing their grass skirts — grass skirts, after all, are items in the endless exchange of goods that goes on — girls are never allowed to flirt, and all love, even the affection between brother and sister, is measured in goods. Here among these small Stone Age villages there was prostitution, and the owner of a war-captured prostitute made money. Here a woman never loosens her grass skirt even in the extremes of childbirth. Between husbands and wives sex is a hasty, covert shameful matter ; and otherwise it is adultery heavily punished by vigilant puritanical ghostly guardians. Women's roles and men's roles are very slightly differentiated ; both participate importantly in the religious system, both conduct economic affairs. If a man is stupid, his relatives seek for him a bright wife to compensate for his deficiencies."

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* *Taken from Mead, M. (1949). Male and Female.* New York : William Morrow & Co. Inc.

It becomes obvious that the child cannot be viewed apart from the community in which he is growing up, and in which he has to succeed as an adult, and that therefore all efforts to improve his health and welfare must, if they are to be accepted willingly, be in accord with his community's values and expectations.

Where a fair skin is a sign of beauty and good breeding or rank, it is often difficult to persuade mothers to expose their little girls to the sunshine. Again, where boys are more highly valued than girls, the young wife may be forbidden to breast feed her baby daughter, in case the chance of the birth of a son is thus delayed.

Perhaps the most startling example of the difficulty of changing standards of " health " in its widest sense comes from the island of Dobu, where the " social forms which obtain (in Dobu) put a premium upon ill-will and treachery and make them the recognised virties of the society ! " Here the abnormal simpleton " was the man who was naturally friendly and found activity an end in itself. He was a pleasant fellow who did not seek to overthrow his fellows or to punish them. He worked for anyone who asked him, and he was tireless in carrying out their commands. He was not filled with a terror of the dark like his fellows, and he did not, as they did, utterly inhibit simple public responses of friendliness towards women closely related, like a wife or a sister. In any other Dobuan this was scandalous behaviour, but in him it was regarded as merely silly " (BENEDICT, 1935).

The inter-dependence of the young child's health and the behaviour, not only of its immediate parents but of the whole group to which it belongs, has been made tragically clear in recent years. Protein malnutrition is one of the chief causes of ill-health in this age-group in many parts of the world to-day. The contributing causes are many, but it appears that in some areas an important one has been the curtailment of the breast-feeding period due to the breakdown of the traditional customs of separation of the husband and wife during the suckling period. Discussing this form of child malnutrition as it occurs in Fiji, MANSON-BAHR (1952) quotes the following passage from THOMSON (1908) : " As soon as his wife was confined he (the husband) was banished to the ' Mbure-ni-sa ' (bachelor house) for the entire suckling period, which lasted from two to three years . . . Natives, when asked to account for the decrease in their numbers, have for years mentioned the breaking down of this custom of abstinence as the principal cause, asserting that cohabitation injures the quality of the mother's milk. Not understanding the true cause that lay behind this belief. European medical men, as well as missionaries, have treated this opinion with contempt, without, however, shaking the native's fixed belief . . . the fear of impoverishing her milk, was a superstition which hid behind it a most important truth, namely, that a second conception taking place during the suckling period must cause the child to be prematurely weaned." He adds " Thus, with the breaking down of Fijian custom and more frequent pregnancies, the children are weaned earlier, and as no substitute is available in the form of cow's milk, a sudden deprivation of protein occurs. The infant is left at the end of the queue at the communal eating mat and has no chance of obtaining any of the choice protein foods which are consumed by the older men."

The last sentence illustrates well another hazard to the health of the child in this age group — one which is particularly prevalent to-day — the unevenness of change. Here one aspect of the traditional methods of child feeding has changed, but others have remained. Formerly, the child of three, with a relatively mature digestive system, could probably " make do " with the bulky taro, tapioca, or yam which formed the major part of the family fare, having had a good " protein start " from the customary prolonged breast feeding. But for the child weaned at nine months or a year, the unchanged custom of reserving the protein delicacies for the elders becomes a major tragedy. Similarly, the belief held by some peoples in this region that the young child cannot be given fish or eggs may have much more importance than in the past, as it may deprive the now early weaned child of the only suitable protein locally available.

It is sometimes difficult for the child health worker to understand the force of various beliefs and taboos in the lives of the more unsophisticated peoples, but, in fact, the situation does not differ greatly in the more developed areas of the region. The child from 1 to 6 years in, for example, Australia is, or can be, protected from the major hazards to its health by various actions carried out at family, community or State level. The problem of dental caries, practically universal among the child population, remains, however, still unsolved — not so much because of lack of knowledge, but because of the strength of the traditional customs and values pertaining to certain foodstuffs. It would take a courageous mother to break with tradition and the expectations of her group and provide, for her five-year-old, a birthday feast that was not highly cariogenic. It would be equally difficult for her to allow her child to go bare-foot or shod in the non-deforming wooden clogs, and so avoid the other practically universal affliction of the " civilised " adult — the hallux valgus deformity of the foot. How much more difficult it must be for others, whose traditional beliefs include witchcraft and sorcery (perhaps performed over carelessly deposited excreta) to exchange the secret place in the bush for the latrine which anyone with evil intentions can get at easily. The following extract is applicable to some peoples in the Pacific region. " Because from early childhood Africans are habituated to a culture different from ours, they may be expected — in our generation, at least — to employ their talents and interests in directions different from those in which we employ ours. Development and other policies will be misdirected if we ignore this, and particularly if we ignore or under-estimate the hold of witchcraft beliefs. So long as the African explains illness, crop failure and industrial accidents in terms of the machinations of witches, and not, as we do, in terms of microbes and misadventure, and as long as his economic and social advances are accompanied by crippling fears of retaliation from those he has left behind, he will participate in development schemes with hesitancy and reservation — if he participates at all." (MARWICK, 1956).

Even without the problem of witchcraft to complicate matters, how can a people whose whole way of life depends on preserving the idea of masculine prestige (which entitles the man to receive the meat distributed at the feasts) be persuaded that it is the small growing child who should have this priority ? Or little girls be taught a pride in personal hygiene and well combed hair when such interest is frowned upon socially as evidence of flightiness in a future wife, whose chief virtue is her capacity to work hard and long in the gardens ? To encourage even minor improvements in the health and welfare of the child, each health worker must, apparently, try to imitate the social anthropologist. " There was a time when a social anthropologist was content to make an inventory of the elements, both material and non-material, of the way of life or culture of a people. Now he concerns himself primarily with the social significance of these elements. He assumes that each culture-element has a reason for existing, and that this is to be found in the contribution it makes to the effective organisation, and ultimately to the survival, of the group concerned." (MARWICK, 1956).

Nevertheless, in spite of the wide variation in the different cultural groups, there appear to be certain common elements in the treatment of children in the family situation in this region. These have been outlined — with the reservation that " only proper study can provide us with the information we need in any particular society " — as follows (FIRTH, 1953) : Children are wanted ; they are considered socially important and protected before birth by the pregnancy rules and taboos for the mother, and sometimes also for the father. The feeding of infants is more permissive, the breast being given when the child appears to want it ; suckling is continued longer, and weaning is a more protracted process than in the West. The wide kinship groups and the lack of privacy in village life contribute towards a less rigid form of child discipline, administered by a variety of people, including the older children — and also encourage the child to become independent of its parents at a comparatively early age. Education is directed more to social ends than to the acquisition of individual skills — though mothers may deliberately teach their daughters crafts, and time and attention be given to the learning of complicated kinship relationships and genealogies.

The children, by the time they have reached their fifth or sixth year, will have been weaned—either gently or abruptly—and experienced hunger, frustration, and the vagaries of their guardians and of an unstable or a settled life. They will have learned to walk, to play, to imitate or to take part in some of the adult activities ; to eat certain foods, and avoid others ; have learned some of the traditional taboos ; and heard of some of the spirits that menace or protect them ; have gained some impression of their status as males or females in the community ; and often assumed responsibilities and acquired knowledge not usually shared by their contemporaries in Western cultures. The child may still be with its own parents, or have been lent — for various reasons — to another relative, or adopted by a different family, sometimes of a different culture altogether. It may have been deprived of both its parents and its home — as where custom decrees that, on the death of one parent the children must remain in the village of the dead parent while the other returns to his or her hostile village, never to be seen by the children again.

During these years, the health and welfare of the child will thus have been affected by its own experiences and by those of its parents and the community of which he is a part. Behind the practical and visible influences are the values held by those within his social sphere, by which the norms of behaviour and achievement are set, the abnormal defined and revered, tolerated or punished as the case may be, and success or failure as a community member recognised. And behind these are the constant pressures of change — some " impersonal " (floods, crop failure, political or economic changes), and some deliberately applied by individuals who may or may not belong to the same culture. The health worker, whether he belongs to the same culture or not, and no matter how sympathetically he considers the " felt needs " of the people, is inevitably an instrument of change, making judgments based on an entirely different set of values and encouraging action and change based on these judgments.

It is essential to remember that " no social order can separate its virtues from the defects of its virtues " (BENEDICT, 1935), and to try to see the possible future defects of the virtues which seem so obviously desirable now. To do so, it will be necessary to learn the difficult art of scrutinising our own customs and values as objectively as we scrutinise those of other people. It may not be completely possible, but we can try, and the past is full of warnings to guide us.

Child health, like charity, begins at home. It is just possible that lasting improvement in the standards of health and welfare of the children in the remote mountains and islands of the West Pacific will only be achieved when we have put our own house in order and changed some of our own standards and values.

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PROBLEMS OF THE PREMATURE INFANT IN THE TROPICS*

by

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In addition to the usual problems posed by premature infants the world over, certain special problems exist in most tropical regions. These are occasioned by many factors, including geography, climate, education, race, cultural patterns, socioeconomic conditions, attitudes of governments and health authorities, and specific training of doctors, nurses, and ancillary personnel. The hazardous adventure of being born and the inherent physiologic handicaps of these little human beings are only part of their problem of survival.

I should like to discuss these problems as they exist in Mexico, Central America and South America. I speak from the experience of having served as Consultant to the World Health Organization in 1955, conducting a Survey of Pediatric Education that took me over a three month period into almost every country of Latin America. I visited practically every medical school and children's hospital and discussed problems of the premature infant with almost every pediatric professor, as well as with many health authorities. In 1956 I returned to Brazil for a month as Consultant to the Rockefeller Foundation and again had the opportunity of visiting many hospitals and nurseries and seeing to what extent modern care of premature infants existed.

Although good work with premature infants is going on in many of the countries of Latin America, and some of the medical centres are quite advanced in this field, the general level of care is relatively low, for reasons now to be discussed.

Geographical factors. The fact that so much of the tropical area of the Western Hemisphere consists of lofty mountains and almost impassable jungles handicaps tremendously the extension of modern medical facilities into many of the areas where premature infants are being born. Difficulties in transportation and communication imposed to a great extent by geographical barriers thus result in a dangerous degree of medical isolation. One can imagine the hazards to a premature infant born in the wild and inaccessible mountains of Mexico, the trackless desert of eastern Peru, the impenetrable vast jungles of the Amazon valley, or the dark depths of the Matto Grosso. Civilization has barely touched many of these areas and health standards are very low. In these and many other areas the health of premature infants will depend upon extension of road networks, railroads, and air transportation which are the prerequisites for bringing to these underdeveloped areas the blessings of modern medicine.

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Climate. One can scarcely imagine a more varied climate than that of the tropics of the Western Hemisphere. It ranges from the steaming heat of Panama and Brazil to the bitter cold of the high Andes. Many of the people of the poorer class are inadequately clothed and dwell in huts poorly constructed from the standpoints of heating, ventilation and cleanliness. In the rainy season there is dampness of dwellings, increased frequency of respiratory infections that may be carried to the premature infants, and more overcrowding. In the dry season in many areas the extremely low humidity leads to increased losses of fluid from skin and lungs, so that dehydration advances more rapidly when the infant contracts a condition that leads to vomiting, diarrhoea, or fever. Climate also governs types of insects, many of which may bring disease, as, for example,the mosquito.

Education. All over the world the health of peoples is intimately related to the general level of education, because educated persons know what constitutes good medical care and value its attainment. Although in the cosmopolitan centres of the tropics the level of education is high among the more privileged groups, almost all of the countries of the Western Tropics have a high rate of illiteracy and ignorance. In many areas superstitions and folklore govern health standards and the premature infant's care suffers, just as that of all children. The extension of educational facilities into the remote areas and their improvement in the settled communities is part and parcel of the problem of the premature infant. Much is being done along these lines, especially by some of the more progressive governments which have instituted programmes for midwives, have established well-baby clinics, and have sought to combat traditional practices that are injurious to health.

Race. The great variety of races found in the tropics of the Western Hemisphere compounds the problem of establishing adequate health standards. Many of the countries in this area have indigenous native Indians whose general level of education and health is below that of the white population, largely composed of persons of European stock, especially from Spain and Portugal. The large numbers of Negroes in Brazil also pose many problems in the fields of education and health which have a bearing on the premature infant. And, then, there are the various mixed races representing a blend of two or more cultural patterns. This lack of homogeneity of populations makes it more difficult for governments to establish fixed high standards in the field of health.

Cultural patterns. In this vast tropical area where live peoples of such varied background, it is only natural that cultural patterns would vary enormously. Manner of living, dietary habits, degree of organization of the family as a unit, extent of community organization, attitude toward sickness and death, all are parts of a broad cultural pattern that has a bearing on survival of premature infants. Birth rates are high but death walks close to life. One cannot say that the backward peoples of this area look with equanimity upon sickness and death, but these events are so commonplace and expected that there is not the constant desire to obtain medical care, and to move heaven and earth to survive, that is so natural in more advanced areas and in the cosmopolitan centres of these countries themselves.

Socio-economic factors. Poverty is the brother of disease and death. In all the world sickness and death prey chiefly upon the poor. Small wonder that the high incidence of proverty among large segments of the populations of the Western Tropics plays such a large role in morbidity and mortality of premature infants. Great numbers of people eke out a bare existence, live in miserable huts and hovels, scarcely subsist on grossly inadequate diets, and have not the means to give their children proper food, clothing, attention and care. It is difficult for a North American travelling in these areas, constantly witnessing the spectre of starvation, to give an intelligent answer when educated Latin Americans ask why the United States maintains such huge food surpluses. Hoarding food in a world that starves is absolutely inexcusable. Surely means can be found to send our surpluses to countries where starving people can have the food without disrupting the internal economy of the receiving nations.

The generally low socio-economic level of most of these countries is the chief reason that there are not more hospitals, more health centres, more well-baby clinics, more nurses, doctors, social service workers, etc. The health of the people, of which the health of prematures is only a small part, depends upon directing more funds for training adequate numbers of health personnel and building necessary facilities.

Attitudes of Governments and health authorities. The vigour and intelligence with which governmental and health authorities organize health services governs to a great extent the survival rate of premature infants. As would be expected in an area so large as the Western Tropics, these efforts vary tremendously. Where enlightened governmental authorities accept the wise advice of educated health officers, and where there is a will to get a job done, much is being accomplished for the health of the people. In other areas, where the government and the health service are characterized by a *laissez-faire* attitude and only go through perfunctory motions of establishing proper services, the health of the people suffers. Venezuela is an excellent example of a tropical country that is hammering away at its health problems and thereby reducing death rates. Other countries are also making every effort within their means, but some are not.

Training of medical personnel. The key figure in any health programme is obviously the doctor, himself, although he needs the intelligent services of ancillary personnel such as nurses, technicians, social service workers, sanitary engineers, etc. The survival of premature infants could be increased greatly in many of the countries of the Western Tropics if there were more and better-trained physicians and other personnel listed above.

Unfortunately, medical education in Latin America is badly handicapped by several factors. The average young physician graduating from medical school has not been given the high quality of training he deserves.

To begin with, many of the medical schools admit any and all applicants, with little attempt at screening. Often it is considered a denial of true liberty to bar an applicant from entering the university. This results in acceptance of poorly prepared students who cannot pass medical school courses. Most of all, it results in accepting far too many students into the freshman class — 1500 to 2000 a year, for example, in one school in Mexico.

Such hordes of students are taught *en masse*, facilities are not adequate for personalised laboratory experience, sufficient well-supervised clinical work cannot be arranged, often class attendance is not compulsory. and the whole method of training is slanted toward didactic presentations rather than personal, practical work with patients. No wonder such students so often graduate poorly equipped for the future. In most countries there are no internships in the true sense and residency training is practically nonexistent except in a few well-run centres.

The average young doctor in Latin America has received pitifully little training in pediatrics, and even less in the problems of premature infants. Perhaps this explains why so many of the nurseries are badly organized, inadequately staffed, and most unsanitary from the standpoints of lack of hand-washing technique. isolation precautions. insect control, etc.

Lest we become too preoccupied with the socio-economic and general educational problems of these under-developed countries, let it be said that a major step forward in reducing death rates of premature infants would be good. sound, medical training of doctors, nurses, and all those upon whom the fate of prematures depends. The doctor must be the leader. He must know what constitutes good care. Where proper facilities do not exist, he must wage a ceaseless and diplomatically conducted campaign to obtain these facilities. Not enough physicians are insisting on proper arrangements for the care of premature infants. Most of this is due to lack of good training in problems of newborn infants.

CONCLUSIONS

We see, then, that a consideration of the premature infant in the tropics must be based upon a broad view-point that encompasses many factors that have a bearing upon his survival. Although, doubtlessly, other factors could have been discussed. I have approached this subject from the standpoints of geography. climate, education, race, cultural patterns, socio-economic conditions, attitudes of governmental and health authorities, and last. but not least, the specific medical technical training of the physician himself and the ancillary personnel so necessary if these tiniest of human creatures are to be given their chance to survive.

EXCERPT

SOME ASPECTS OF THE HAIR CHANGES IN KWASHIORKOR

(B. S. NARASINGA RAO AND C. GOPALAN. *Ind. J. med. Res.*, 1957, 45, 85)

Six amino acids were estimated in the hairs of a series of normal Indian children, of African cases of kwashiorkor in different stages of treatment. and of Indian children with kwashiorkor and simple undernutrition. There is a significant reduction in the cystine content of the hair in cases of protein malnutrition. irrespective of the fact whether the hair is discoloured or not and that this abnormality is reversed after a few weeks of treatment with high protein diet. There is no correlation between dyschromotrichia and the content of amino acids investigated. It would appear from the present investigation that cystine content of the hair may be a better indication of the severity of protein malnutrition than the hair discolouration.

THE BACTERIOLOGY, MICROSCOPY AND TREATMENT OF DIARRHOEA IN CHILDREN IN UGANDA

by

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Diarrhoea is a common and serious problem in children in all parts of the world. The mortality is considerable and the causes are many. Whilst there is some evidence that the aetiological agents in tropical areas differ largely from those in temperate countries, knowledge of the aetiological patterns in different tropical areas is still scanty. No investigation of the bacterial causes of unselected cases of diarrhoea in children has been reported from East Africa, and it was therefore thought desirable to study the stools of a group of such cases with the primary object of determining what proportion are due to a demonstrable infection of the intestine with Shigella, Salmonella or *Escherichia coli* 026, 055 or 0111. Secondly, it was realized that the microscopical findings of stools will be more easily available to many medical centres in the tropics than the bacteriology, and for this reason the stools of these cases were examined microscopically to determine whether any correlation could be made out between these findings and the presence of pathogens. Thirdly, the results of treatment with chloramphenicol and streptomycin, and, in some cases, dietary measures only, were examined and compared. It was hoped that, if microscopical findings were found to be a reliable indication of the probable presence of pathogens, they could then be used as a guide to appropriate treatment.

The series comprised 100 consecutive children admitted to the Children's Wards of Mulago Hospital, Kampala with diarrhoea or developing it after admission. Ages varied from 10 days to 4 years, two-thirds of the patients being between 5 and 18 months. For inclusion in the series no selection was exercised with regard to age, clinical impressions of the cause, previous treatment, or the presence of other diseases ; a number of cases of kwashiorkor were thus included, and this was thought desirable in view of reports of an appreciable incidence of Salmonella infections in kwashiorkor elsewhere (JELLIFFE et al., 1954). In deciding treatment, however, the above factors were taken into account.

METHODS

As soon as it was decided that a patient satisfied the criterion for this series of having passed 5 stools or more in 24 hours, and before hospital treatment was started, a rectal swab was taken and rubbed immediately on to half a desoxycholate citrate agar (DCA) plate in the ward and a single stool was collected as soon after this as possible. Inoculated DCA plates and stools were collected twice daily from the ward. In the laboratory the inoculum on the plate was thinned out and the stool was examined microscopically and inoculated onto a further DCA plate and also onto a McConkey plate and into selenite and tetrathionate broths. The fluid media were subcultured onto DCA next morning. DCA plates were incubated for at

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* Seconded to Mulago Hospital, Kampala, Uganda.

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least 48 hours before being considered negative. Non-lactose fermenting colonies were examined by the routine biochemical tests and potential pathogens were then tested for agglutination on slides and, if positive, were confirmed in tubes, at any rate on the first two occasions on which any particular organism was isolated. At least one colony of each visually differentiable type of lactose fermenter on the McConkey plate was tested on a slide with sera prepared against *Escherichia coli* groups 026, 055, 0111 and all those giving positive results were checked by tube agglinations to demonstrate O and K antigens separately.

Microscopical examination was carried out on suspensions of each stool in saline, and where indicated, in iodine and eosin preparations also.

BACTERIOLOGY

100 rectal swabs and 87 stools were cultured and pathogens of the groups sought for were isolated from 33 patients. Details of the organisms and the number of patients from whom they were isolated are given in Table I.

TABLE I. Accepted pathogens isolated from 100 consecutive children with diarrhoea at Mulago Hospital, Kampala, Uganda.

Group		No. positive	Total
Shigella*	*Sh. schmitzi*	2	
	Sh. flexneri 2a (W) 1 2b (WX) 11 3 (Z) 1 4 (103) 2 6 (Manchester) 1	16	
	Sh. boydi 4 (P274)	1	
	Sh. sonnei	6	25
Salmonelle	Group B : *S. typhimurium* (2 in the non-specific phase)	3	
	Species not determined	2	
	Group D : *S. enteritidis*	1	6
Escherichia coli	0 Group 26	1	
	0 Group 111	2	3

* One double infection (*Sh. flexneri* 2b and *S. typhimurium*) was found.

Comparison with series from other parts of the world

No strictly comparable series are available as different age groups of children and different bacterial groupings and classifications have been used and series often include both epidemic and sporadic cases. The present series except for one pair of twins are, as far as is known, all sporadic cases unconnected with each other.

Shigella. The incidence of Shigella infection in this series (25 per cent.) is relatively easy to compare with that in other series as the group is relatively stable taxonomically and usually reported separately. However, the proportion of diarrhoeas in children due to Shigella increases with age (and in some series the absolute incidence as well) so that the age range of the group is important. The figures vary from 15 per cent. to 50 per cent. with most of them lying between 25 per cent. and 30 per cent. (North America : COOPER et al. (1939), LEVINSON and RAYCRAFT (1950). South America : HORMAECHE et al. (1943). Syria : MOORE and DENNIS (1940). East Africa : WRIGHT (1954), MACDOUGALL (1955)). HUGHES (1955) reports from Sierra Leone that Shigella were grown from 10 per cent. of the stools sent in from children of 3 and under, but the clinical diagnosis of the patients was not known. The significance is therefore uncertain, particularly in view of the report of FLOYD (1954) that a weekly survey of village children under 1 year living under poor conditions near Cairo showed that 8 per cent. of *all* rectal swabs grew Shigella.

Salmonella. Comparison of the incidence of Salmonella isolated in this series (6 per cent.) with that in others is less easy, as Salmonella are a larger and less clearly defined group containing many unnamed members and are sometimes included with other groups of non-lactose fermenters. The figures for the proportion of cases of diarrhoea in children due to Salmonella other than typhoid or paratyphoid organisms vary from nil (WOLLSTEIN, 1921) to 23 per cent. (HORMAECHE et al., 1943). The latter in Uruguay found Salmonella less common than Shigella but the reverse is true in Jamaica (JELLIFFE et al., 1954) and in Dar-es-Salaam (MACKEY, 1955).

Pathogenic Escherichia coli. Figures for pathogenic *E. coli* are mainly from temperate zones and often include patients involved in epidemics, so that the importance of a particular strain as a cause of diarrhoea among the children in that area in general cannot be assessed from such figures. Pathogenic *E. coli* have rarely been reported from Africa, but an epidemic due to 055 in a Maternity Home with a few sporadic cases outside was reported from Dakar (DARASSE, DUPIN and CORREA, 1954). KAHN and ROBERTSON (1952) looked for them specifically in a small series from Johannesburg, but failed to find any.

Other organisms. Non-lactose fermenters not belonging to the Shigella or Salmonella groups were common in this series especially *Proteus morgani*, which was found in a quarter of the children. It was present in one half of those still being entirely breast fed and was the only coliform present in one of them. Whether this is connected with age, breast feeding or diarrhoea must await further study. *Ps. pyocyanea* was only found in 5 patients and the isolation of other non-lactose fermenters did not appear to correlate with any other features of those cases.

Staph. pyogenes was not specially sought for and was found in the stools of one patient only — a child of 3 months. It was not the predominant organism and diarrhoea had been present for a week. *Strep. faecalis* was frequently present but never as the predominant organism. The anaerobic flora of these stools were not investigated. Monilia were one of the predominant organisms grown in 3 cases, two of which also yielded Shigella.

Value of different media in isolating pathogens

The material is too small to justify detailed reporting, but there are some clear conclusions. Plating a rectal swab on DCA in the ward proved to be a good method for isolating both Shigella and Salmonella, though not the best method for either. The value of this method is that it can always be carried out and the collection is at the convenience of the ward staff. Because sometimes rectal swabs were plated, but stools were forgotten or because treatment was started in-between plating a rectal swab in the ward did in fact yield more positives than any other method.

The best single method for isolating most Shigella species was the plating of faeces on to DCA, though for *Sh. sonnei* and *Sh. flexneri* 6 (Manchester bacillus), enrichment in selenite broth was sometimes better, as was noted by HUGHES (1955) in W. Africa. Other types of Shigella did not survive selenite and none survived tetrathionate broth. For Salmonella, however, tetrathionate broth was the most fruitful medium and the direct plating of stools was clearly inferior.

TABLE II. Microscopical features of stools correlated with the isolation from them of pathogens. Number of stools examined — 87. Number of pathogens isolated — 30.

Microscopical features	Stools *with* the relevant microscopical feature					Stools *without* the relevant microscopical feature				
	Number of stools	Pathogens isolated				Number of stools	Pathogens isolated			
		Shigella	Salmonella	Path. *E. coli*	Total		Shigella	Salmonella	Path. *E. coli*	Total
Red blood cells	13	12	0	0	12	74	10	5	3	18
Pus cells	53	21	3	2	26	34	1	2	1	4
Mucus	50	18	3	3	24	37	4	2	0	6
Absence of fat droplets	50	20	4	0	24	37	2	1	3	6

TABLE III. Results of treatment correlated with the pathogen (if any) isolated. (The number of cases will appear different from those in Table I as some patients were treated by more than one method).

Pathogens isolated	Method of treatment											
	Chloramphenicol				Streptomycin				No antibiotic			
	Response			Total	Response			Total	Response			Total
	Rapid	Moderate	None		Rapid	Moderate	None		Rapid	Moderate	None	
Shigella	18	1	None	19	3	1	4	8	1	1	1	3
Salmonella	1	2	1	4	None	1	None	1	None	None	1	1
Pathogenic *E. coli*	1	1	None	2	1	None	None	1	—	—	—	—
All pathogens	20	4	1	25	4	2	4	10	1	1	2	4
No pathogens isolated	15	4	11	30	8	3	4	15	15	8	9	32

MICROSCOPICAL FINDINGS

The stools were examined in 87 cases and the findings are set out in Table II. It also gives the numbers of pathogens isolated from all those stools which showed a particular microscopical feature.

Red blood cells were only reported in 13 stools (15 per cent.) as the criteria were kept very strict and where there was any doubt about this important abnormal finding it was reported as negative ; the figure is therefore likely to be an underestimate. 12 of these 13 cases yielded Shigella on culture. The other yielded no pathogen but there were many pus cells present and it was probably a case of bacillary dysentery in which culture was unsuccessful.

Pus cells were seen in 53 stools (61 per cent.) and half of them yielded pathogens. Pus cells were recorded as " many " in 20 of the 53 stools and 85 per cent. of these yielded pathogens, all but one of which were Shigella.

Mucus was seen in 50 stools (58 per cent.) and half yielded pathogens, but the likelihood of growing a pathogen did not increase with the amount of mucus present.

Both pus cells and mucus were seen in 41 stools (47 per cent.) and 22 yielded pathogens — again about half. In the 25 stools where neither mucus nor pus cells were seen, only 2 pathogens were isolated and both were Salmonella.

Fat droplets. The presence or absence of fat droplets was among the features recorded for each stool though it was not known to have any significance when the series was started. It was noticed fairly early on however, that although fat droplets were present in about a third of the stools none of them had yielded any Shigella. In the complete series, fat droplets were seen in 37 stools (43 per cent.) but, apart from all the three pathogenic *E. coli*, they yielded only 3 pathogens, and, furthermore, from the 14 stools where many fat droplets were present, no Shigella or Salmonella were isolated at all. On the other hand, half the 50 stools in which fat droplets were absent yielded pathogens.

In this series, the absence of fat droplets was as good an indication of the likelihood of isolating Shigella or Salmonella as the presence of pus cells and it is remarkable that a preliminary search of the literature has revealed no previous record or comment along these lines.

Significance of Microscopical Findings

Within this group of patients some working conclusions on the correlation between microscopical findings and the likelihood of isolating dysentery organisms seem tenable :

(i) The definite presence of red cells or of many pus cells makes the isolation of one of the Shigella group very likely.

(ii) The presence of pus cells or mucus or the absence of fat droplets means that isolation of Shigella may be expected in about 40 per cent. of cases, and

(iii) The absence of pus cells and mucus or the presence of many fat droplets makes it unlikely that the stool will yield any Shigella (though Salmonella or pathogenic *E. coli* may be found.)

The number of stools from which Salmonella or pathogenic *E. coli* were isolated is small but they suggest that little can be predicted from the microscopical appearances. In the six Salmonella infections, red cells were not seen, pus and mucus were present in half, but only once in large amount. Fat droplets were seen only once. In the *E. coli* infections the findings were similar, except that fat droplets were seen in all three.

The value of the microscopical features of the stool as a help in reaching a diagnosis on which treatment can be based (rather than predicting the probability of isolating the causative organism) is more difficult to assess, but for the doctor without bacteriological resources it is much more important.

Where blood cells or many pus cells were found, isolation of a dysentery organism was the rule and in such cases bacillary dysentery can reasonably be diagnosed without bacteriological proof.

Where, however, stools showed mucus and some, but not many, pus cells, pathogens were grown in only about a quarter of the cases and they belonged to all three groups. The cause of the diarrhoea in the remaining three-quarters of these cases was not clear ; it may have been an unrecognised intestinal infection or possibly this type of microscopical finding may be due to other causes. The problem requires further study, but some comment is appropriate.

Of the common and established causes of diarrhoea in children in this part of Uganda—bacillary dysentery, kwashiorkor, parenteral bacterial infections and malaria — only the first is known to lead to the presence of pus cells and mucus in the stool, and in the few cases in this series where there was evidence of intestinal infestation with helminths or protozoa, no correlation with the presence of pus cells and mucus was found. On the basis of this partial evidence, which is clearly not conclusive, we believe that the vast majority of the children whose stools contained pus cells and mucus, were or had been suffering from intestinal bacterial infections. The fact that it has not been possible to demonstrate a generally accepted cause (Shigella, Salmonella or pathogenic *E. coli* 026, 055 or 0111) in more than half of them is no real objection to this view. The chances of isolating the causative organism from a single specimen of stool during a proven infection varies according to different authors from 50 per cent. to 85 per cent. and it should be borne in mind that the accepted pathogens sought for in this series may not be the only bacteria capable of producing intestinal infection in small children here.

TREATMENT

Scheme of Treatment. Two drugs were used, chloramphenicol and streptomycin. Chloramphenicol was given eight-hourly in doses of 125 mg., either as a suspension of the powder in syrup or as the palmitate. Streptomycin was given eight-hourly orally in mixtures containing 100 mg. or, in a few cases, 200 mg., where there was no response to the smaller dose. These doses were given irrespective of age or body-weight and were continued for up to six days if no response was obtained earlier. A cessation of diarrhoea within three days was recorded as a rapid response and within three to six days as a moderate response, whilst no response within six days was considered a failure, since those cases treated for longer than this remained refractory. A number of cases, particularly those who were clinically mild and those whose diarrhoea appeared to be nutritional in origin were initially given no treatment other than bland fluids and in the cases of kwashiorkor, appropriate dietary measures. If diarrhoea persisted, however, one or other antibiotic was then given. The " no antibiotic " group was thus not in any sense a control group.

Results of Treatment. The results of treatment in those cases from whom pathogens were isolated and those from whom they were not, are set out separately in Table III. It demonstrates clearly that when pathogens were isolated the results with chloramphenicol are good and markedly superior to oral streptomycin in the doses used.

Further analysis of the group from whom pathogens were isolated shows that every proven Shigella case responded to chloramphenicol, and with one exception, within three days. The few cases with other pathogens responded rather more slowly, and one case failed to respond.

Analysis of the cases without demonstrable pathogens shows that chloramphenicol was less successful than when pathogens were grown, but as the former are a mixed group and the method of treatment was not chosen at random, comparison of the responses to the different methods is uninformative. Most of those not treated with either antibiotic were in fact patients with kwashiorkor in whom diarrhoea can be rapidly controlled by dietary measures and most of those who failed to respond to antibiotics had no pus cells in their stools and were therefore probably not suffering from an intestinal infection.

The correlation between the presence of pus cells in the stools and the success of treatment with chloramphenicol is shown in Table IV. For those without access to bacteriology it is helpful to note that no less than 24 of the 27 patients with any pus cells at all in the stool responded to chloramphenicol and except for two of them, within three days.

TABLE IV. Results of treatment correlated with the presence of pus cells microscopically and pathogens on culture. (The total number of cases (48) is less than in Table III (55) as stools were not obtained from all patients).

Microscopy	Culture	Response to Chloramphenicol			
		Rapid	Moderate	None	Total
Pus cells present	Pathogen isolated	15	2	1	18
	No pathogen isolated	7	0	2	9
	Total	22	2	3	27
No pus cells present	Pathogen isolated	1	2	0	3
	No pathogen isolated	6	4	8	18
	Total	7	6	8	21

Choice of Drug. No attempt was made in treating the cases, to compare the effects of all the possible drugs which are known to be effective in bacillary dysentery. Much information is already available regarding the absorbable and non-absorbable sulphonamides. The consensus of opinion seems to be that they are roughly equal in their efficiency, with a slight bias in favour of the absorbable compounds, and in a recent paper, MACDOUGALL (1955) states that a majority of cases treated by these drugs are free of diarrhoea after seven days.

In the present series chloramphenicol shows a striking improvement on this. All the cases growing Shigellae cleared up within three days, and in most cases, in 1-2 days. It can almost be said that this response is characteristic of Shigella infection. No conclusions can be drawn from its effect on other intestinal pathogens owing to the small numbers, but it appears that the response is slower and less certain in infections with Salmonella and the pathogenic types of *Esch. coli.*

Dose of drug. The results indicate that the dose of chloramphenicol given was quite adequate, though small compared with that used for infections in other parts of the body, and with that used for gastroenteritis in England by SMELLIE (1950).

Streptomycin on the other hand has proved disappointing in the treatment of diarrhoea due to intestinal pathogens. Unlike chloramphenicol it has been shown not to be absorbed when administered orally (ZINTEL et al., 1945) and any effect on intestinal pathogens must therefore be exerted locally. Though the doses used were rather smaller than those suggested by SANGSTER (1956) they were roughly comparable with those used by JAMES, KRAMER and ARMITAGE (1948), and it is therefore doubtful whether the relative lack of success with this drug could be ascribed to insufficient dosage, particularly as no better effect was achieved in the few cases with pathogens in whom the dose was doubled.

Mortality and Severity of Diarrhoea. The deaths in this series numbered seven. None of them yielded pathogens from the stool and in only one case could death possibly be ascribed to the effects of diarrhoea. In the other six patients death was due to kwashiorkor (3), broncho-pneumonia (2) and sickle cell anaemia (1). This absence of death from proven bacillary dysentery is striking and at variance with the experience of other hospital centres (WRIGHT, 1954).

Whilst no control series was studied in this investigation, bacillary dysentery in Kampala has previously carried an appreciable mortality, though rather less than that experienced by WRIGHT (1954) in Nairobi. Though intravenous therapy was used on a more liberal scale in this series than previously, the real innovation was the use of chloramphenicol in treatment and it is to this that we attribute the absence of mortality.

SUMMARY

The stools of 100 children with diarrhoea have been investigated bacteriologically and microscopically. Accepted bacterial pathogens (Shigella, Salmonella or *Escherichia coli* 026 or 0111) were demonstrated in 33 cases and the microscopical findings and response to treatment suggest that twice this number were probably infective in origin. 12 of the 13 stools showing red blood cells microscopically yielded pathogenic bacteria ; they were all Shigellae. Only 26 of the 53 stools showing pus cells and 24 of the 50 showing mucus microscopically yielded pathogens. The significance of this is discussed. 24 of the 50 stools from which fat droplets were absent microscopically yielded pathogens and the 37 stools in which they were present yielded only 6 pathogens, 3 of them Escherichia. The absence of fat droplets was thus as good as the presence of pus cells in indicating a demonstrable bacterial cause for the diarrhoea. This appears to be a new observation. Small doses of chloramphenicol were very effective in the proven cases of bacterial infection and also in patients where pus cells were present in the stools even though no bacterial infection was proven. There were no deaths among the proven cases of bacterial infection and none of the 7 deaths in the series was considered to be due to bacterial intestinal infection.

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NOTES ON WORK IN THE FIELD OF MATERNAL AND CHILD HEALTH AND HEALTH WORKER TRAINING AT BARPALI

by

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In the early days of the project at Barpali we were impressed with the special needs of women in the child bearing period, many of whom came to us in dire condition. Our co-worker, Nurse Bela Banerjee, had previously had a wealth of experience in social service and midwifery in India. She envisioned a clinic for the mothers and babies, and lost no time in beginning her campaign to make it a reality by talking with the women about their children and about a possible clinic. Meanwhile we entertained the idea of training local women as health workers, considering two possible types :

(1) Training of women who were already functioning as local midwives or *dais*. Some effort was made in this direction, but this was disappointing because the *dais* were illiterate women, saturated with superstition. Another hindering factor was that women associated childbirth with things unclean, and therefore tended to look down on the *dais*.

(2) Training of high school graduates, but these proved to be almost non-existent among village women.

In selecting men as village workers the staff had given preference to married men with the thought that their wives might participate in maternal and child health. But at that time the village workers shared the feelings of villagers regarding this type of work, and felt that respectable girls did not go out from house to house in the village.

By good chance when we had been at Barpali only three months, we received the application of Kalaboti, a widow of an influential Brahmin family of Barpali Thana. Although we had no job for her at the time, we took her on in the hope that she might learn the principles of our programme by observation. She soon revealed herself as an intelligent and resourceful woman, eager to learn all she could, persuasive and dignified in her dealings with village women, and driven by a spirit of service rare in our experience with people. As the year continued three more health workers joined our group, and it became evident that Kalaboti had set the standard for the type of woman who would come for training. Villagers who knew Kalaboti's position and family began to accept her role as a health worker, and others of good standing, including wives of village workers, came to join us.

Educational pre-requisites for the trainees were not clearly defined but our experience indicates that they must be able to read and write the local language. The education of those whom we trained varied from those who were self-taught at home to those who had some college education. The majority of the women had received about five years of schooling.

By August, 1953, it was necessary to conduct a formal course of lectures for the first four women. As new workers joined by ones and twos the course was revised. The training programme consisted of six to nine months apprenticeship in general health work, midwifery, and routine village visitation. This was supplemented with classes in simple basic anatomy and physiology, domiciliary midwifery, including asepsis and nutrition, child care, village sanitation, immunization, some case studies, discussion of common diseases of the area, sewing, and literacy.

One full day a week was occupied at the Friday clinic—translating, dispensing medicines, attending some of the cases, and teaching disease prevention to people singly or in groups. One half day was given to the Wednesday Maternal and Child Health Clinic where babies were weighed, alternate mothers were examined, urine was analysed and a number of sterility cases were attended. One or two mornings might be taken up with operations. At least two hours of each of the remaining mornings were devoted to the follow-up clinic and routine clinic maintenance. One or two afternoons were spent in sewing classes in various villages. All delivery cases were attended by one senior worker and usually two juniors under the direction of Bela Banerjee, the nurse. One or two hours a week, depending on the time available were given to classes conducted by the nurse or one of the doctors. The remaining time was spent in routine house to house visiting and sick calls.

On completion of her apprenticeship the health worker was placed in a village. There she began by visiting women in their homes, giving special attention to antenatals and babies. She treated minor cases of illness and usually gathered a group of girls about her for lessons in reading and sewing. As she became established she developed a small maternal and child health centre.

It may seem that unwarranted responsibility was reposed in these workers. Actually there was no-one else in the villages as capable of assuming it. Very simple advice such as addition of milk to the diet of a pregnant woman or referral to the medical centre of those who require a doctor's services, may give dramatic and life-saving results. The gradual increase of such services in a small village very soon makes a noticeable change in the village picture. Workers were impressed with the fact that their main task is in the realm of health education.

Always in mind in this work was the hope that some part of the service might become permanent. Therefore, when each health worker was accepted we explained that the project would pay her a salary for approximately one year after she finished her training. We hoped that there would be sufficient felt need and resources in the villages themselves to ensure her support after that time. An increasing number of villages have requested the services of a worker, but village support has not yet been fully accomplished. Several methods have been suggested or tried, and some support has been forthcoming. Most notable is the " prepaid health service " which is now developing under the guidance of Dr. Shankar Mahapatra.

MATERNITY AND CHILD HEALTH CLINIC

Bela Banerjee's work toward the establishment of a clinic was supplemented by Kalaboti and Sindukumari, the second health worker, as they caught her enthusiasm. By July, 1953, the clinic was opened. At first it was very difficult to persuade women to attend, and many of those who did come were in such desperate condition that they had nothing to lose. It was not difficult to build a reputation through treatment of some of the cases of severe malnutrition. This increased our acceptance in the villages, but more important, it convinced our health workers beyond any doubt that our words on nutrition were true.

During the first year of the clinic three to five antenatal cases attended weekly, and a slightly larger number of sick babies. Sterility cases came in ever increasing numbers hoping for miracles. It was to our surprise, more than theirs, that miracles did occur increasingly as time went on. By the end of the second year of the clinic both the number of antenatal cases and the number of baby cases had trebled. More healthy expectant mothers and well babies who had been attended by our own workers were in evidence, and to some degree we sensed a change in their attitude and a growing faith in the preventive side of the work.

Antenatal and Infant Routines

For Antenatals : We emphasized the need for vegetables and for protein, including a small amount of animal protein. We watched their haemoglobin and supplemented with iron where necessary. We stressed early treatment of the common disorders of pregnancy such as chronic malaria and dysentery.

For Infants : By trial and error we evolved routines which could be taught to health workers. What we learned far exceeded what we taught.

Advice to New Mothers

(1) Continue the diet advised during pregnancy.

(2) Drink copious " safe " fluids to maintain the milk supply. This involved difficulties because of the universal fear of consuming too much water. All the drinking water has to be carried, so that extra demand by one person adds to the household burden. Boiling to make water safe also presents its problem as fuel is scarce. Milk is very expensive, if available, so that whenever possible we made skim milk powder available to prenatal cases and lactating mothers through UNICEF supplies. When UNICEF supplies were not available we advised purchase of skim milk powder in the village shop.

(3) Feed the infant at approximately every two to three hours instead of giving the almost continuous suckling that the malnourished infant demands.

(4) Give boiled water between feedings. This extra fluid is necessary all year around in Central India, but particularly during the three hottest months in the spring when small babies tend to become dehydrated. (Our own 6-month old infant, being fed on demand during April, took a quart of water in addition to a quart of milk formula during the 24-hour period). Giving fluids to infants was not without danger, however, for a grandmother or a great auntie might decide that unboiled water was better ; or she might leave the sugared water exposed to flies ; she would certainly test the temperature of the water with her index finger before feeding it to the infant ; and unless she was forewarned and most conscientious she would rest the spoon on the floor between mouthfuls. Even educated women had to be warned against the practice of soaking the water up in a piece of cloth and squeezing it into the baby's mouth. Supplementary milk feeding was almost never prescribed, for the dangers of giving water were multiplied with the use of milk which is an excellent bacterial culture medium. Use of a bottle and nipple was rarely suggested because of the unlikelihood of adequate sterilization.

(5) A small gauze tent was encouraged to protect the baby from flies and mosquitoes.

(6) Bring well babies to the clinic for routine weighing, and bring sick infants early for treatment.

Infant feeding

At three months : some naturally occurring source of Vitamin C was advised, such as orange or lemon juice, the latter being easier to obtain and cheaper.

At six months : solid food in the form of ground rice cereal was introduced. In a number of cases this ushered in the first acute attack of dysentery perhaps because the food was fed with the hand. Health workers tried to prevent this by intensive education and frequent home visitation.

At seven months : egg was advised. This is disgusting to some as there is a taboo against eggs among all caste people, although technically it *is* permissible to feed eggs to children on medical advice.

At eight months : dhal water (lentil soup) was advised.

At each succeeding month : one new food would be added in small quantities. e.g. vegetables or fish. One difficulty in offering vegetables to infants is that there is no way of making a purée, for neither a sieve nor a fork is found in the villager's household equipment. Vegetables are usually prepared by squashing with the thumb, and faithfulness in washing of hands was strongly urged.

How does Maternal and Child Health fit into the General Health Programme ?

Work in Maternal and Child Health is the foundation of an effective health education programme. This education in the village is directed toward change in the basic habits of eating, drinking, and sanitation — recognized by sociologists as the hardest areas in which to induce change. These changes. moreover, involve problems : in economics — i.e. how to finance an adequate diet : in agriculture — i.e. how to produce the same ; in land division — i.e. where to put the desired garden or latrine ; and in the routine of daily family and social life. This education, therefore. cannot be entered into in a vacuum. Any change which comes about must grow around a nucleus of people who by reason of their progressive spirit and through force of circumstance have been the first to try the untrodden paths. As in other areas of community development, the initial nucleus grows slowly and must be based on the growth of a personal and sympathetic relationship between the technical helpers and the would-be village leaders. The contact in the case of health work almost invariably arises from an acute medical need, and usually one must meet the need before teaching opportunities present themselves. Early in his experience the health teacher must stick to areas in which he is absolutely certain, and he is wise to lay most emphasis on measures which will have early and easily demonstrable results. Some examples would be the addition of protein to the diet of a pregnant woman or a sick child ; the use of safe drinking water. especially for babies, and the liberal use of fluids in dehydrating conditions like diarrhoea and fever. Then, some measure of rapport being established with a few, he must ask scores of questions in order to get an idea of the thinking of the villager — his wisdom. his fears, his follies, and his superstitions in the setting of his everyday life and practice, Gradually. out of his own scientific knowledge, his observations in the field, and his understanding of the local ideas and customs, the technician will build a body of basic public health knowledge. This he must then endeavour to present through all the teaching media known. In none of these stages can the technical worker operate alone. Even if he is born and bred in the area he must, from the beginning. gather around him co-workers who will help him to apply his scientific knowledge to the local and immediate problems. This is where, in our experience. the health worker fits into the scheme. She is both field co-worker to the technician. and also part of the nucleus of village leadership around which constructive changes will grow.

tumor mass in the pelvis. We rarely referred these cases for treatment as it did not seem right to uproot people from their homes and plunge them into debt when their hope of successful outcome was so slight.

Venereal Diseases

Both syphilis and gonorrhea were relatively common. Tertiary syphilis was rare, perhaps, as has been suggested in the literature, because of the common occurrence of fever due to malaria. The chief reason for syphilis coming to light was its repeatedly devastating effect on pregnancy. History varied from one to seven abortions, still-births, or neonatal deaths with a story suggesting primary syphilis in the husband acquired often before his marriage. In some instances a man had taken a second or even a third wife in an effort to produce a viable child. A few cases we confirmed with serology, which we did ourselves, but this could not be undertaken routinely, as it was too time-consuming, and we had no other laboratory facilities available in our district. We treated husband and wife simultaneously with ten daily injections of 400,000 units of penicillin. If the wife was pregnant, we asked her to take an extra five doses during her last month, and to bring the baby to us for check-up as soon as possible after birth. The result was a substantial number of live babies where previously none had been possible. Often, however, it was necessary to treat the baby strenuously during its first month of life with additional penicillin. We did not lose any babies of mothers so treated in pregnancy, as far as we know.

Cases of gonorrhea came to us most often because of sterility. As in the case of syphilis, we saw men who had taken as many as four wives in the hope of producing a child. Less commonly, the presenting symptoms and signs were of chronic pelvic inflammatory disease, and rarely did we see an acute case. In the villages this disease is treated with herbs and usually men seem fairly satisfied with the results. Diagnosis of gonorrhea tended to be made indiscriminately by the herbalist, so that it was necessary for us to do a lot of careful checking and sorting of the details of the history before making our diagnosis. We gave the same treatment as for syphilis to husband and wife simultaneously. We were a little surprised to find that women who had been sterile for years sometimes became pregnant within a few months of taking treatment.

FAMILY PLANNING

Sterility

In India, having a family is of paramount importance because of certain religious and social concepts as well as for security, especially in old age. It is, therefore, not surprising that sterility was a pressing problem in our clinic. During our second year in Barpali more than twenty cases a week consulted us, asking us to give them a child. We worked out a routine whereby the cases were first sorted out by a health worker who (1) sought a history of chronic malaria, (2) questioned and examined for signs of avitamiosis, (3) inquired about the possibility of gonorrhea, and (4) elicited the menstrual history. Malaria and frank avitaminosis were treated by the health worker, who also gave each woman a chart illustrating the monthly fertility cycle. Cases of venereal disease, menstrual irregularity, and other possibly pathological conditions were referred to the doctor. Gonorrhoea and syphilis were treated as described above. Other causes of ill health were sought and treated. With regard to menstrual irregularities, by far the most common type was scanty irregular periods delayed for intervals of a few days to months. In the absence of other demonstrable disease thyroid was given to these cases—½ grain daily for one to three months. In all cases dietary advice was given.

Results were startling, and it was no wonder that rumours of magic spread quickly through the villages. Adequate records during the initial stages of the clinic were impossible because of incomplete follow-up. Often we heard by rumour of the miracles achieved. Sometimes it would be revealed when a baby was brought to us, and the parents, expecting us to remember, would say, " You gave us this child." Of the much smaller number of successes that we were able to follow personally, we can only list the types of cases according to our impressions of their frequency. Most commonly the combination of anti-malarial drug with vitamins plus dietary advice was credited with favouring the pregnancy. This incidentally helped to boost the reputation of our health workers. A close second was treatment of venereal disease. We know a small number who seemed to owe the pregnancy to thyroid ; a few received no treatment aside from the fertility chart and dietary advice.

Some have questioned our enthusiasm for this work in the field of sterility in a country where over-population is already a serious problem. We can only say on humanitarian grounds that a childless home deserves a child wherever it may be. Also, the child so achieved is more likely to be adequately cared for than children of large families.

Birth Control

Although we were interested in the field of birth control from the beginning of the clinic, our opportunities were limited. At first we were sure that " rhythm " was the method of choice where cost and aesthetic considerations were important. Mostly women of more educated families consulted us at first, and it was not too difficult to make this method intelligible to them. When we tried to describe it to completely uneducated village women, however, we found that it was incomprehensible to people who cannot count and who are not trained to deduce abstract ideas from drawings or charts. Disadvantages of the method, then, were : (1) the difficulty in making it clear ; (2) the fact that more often it was only women and not the husbands who were interested in limiting the family ; (3) it did not appear to be efficacious enough when it was honestly tried to convince our health workers of its usefulness.

Following the realization that our first trial was a failure we began working in two directions. First was to make available commercial contraceptives to those who could afford them ; and second, to find a method which cost little or nothing for poor women who were demanding help. We decided against the use of a diaphragm because we felt that rubber products would perish quickly in the heat and also because we decided against trying to break down the barriers of shyness to teach women to handle the diaphragm accurately. We obtained " Preceptin " through Imperial Chemical Industries at their trade price of R. 4 (6/- or $0.80) per tube. Wealthy people did not mind trying it, but poor people could not undertake the repeated outlay of such a sum. We had two known failures with " Preceptin," among our regular attenders, one of which proved serious as the mother developed active tuberculosis during the pregnancy (her 11th).

For those who could not afford " Preceptin," we worked on the use of hypertonic salt solution as a spermicidal agent, following reading some reports on the subject. We decided to try using a rice paste as a base, but ran into the following difficulties : (1) making the paste was too much trouble for the women, and the paste would not keep because of the heat, (2) people had no faith in the use of such common ingredients, (3) our health tumor mass in the pelvis. We rarely referred these cases for treatment as it did not seem right to uproot people from their homes and plunge them into debt when their hope of successful outcome was so slight.

Venereal Diseases

Both syphilis and gonorrhea were relatively common. Tertiary syphilis was rare, perhaps, as has been suggested in the literature, because of the common occurrence of fever due to malaria. The chief reason for syphilis coming to light was its repeatedly devastating effect on pregnancy. History varied from one to seven abortions, still-births, or neonatal deaths with a story suggesting primary syphilis in the husband acquired often before his marriage. In some instances a man had taken a second or even a third wife in an effort to produce a viable child. A few cases we confirmed with serology, which we did ourselves, but this could not be undertaken routinely, as it was too time-consuming, and we had no other laboratory facilities available in our district. We treated husband and wife simultaneously with ten daily injections of 400,000 units of penicillin. If the wife was pregnant, we asked her to take an extra five doses during her last month, and to bring the baby to us for check-up as soon as possible after birth. The result was a substantial number of live babies where previously none had been possible. Often, however, it was necessary to treat the baby strenuously during its first month of life with additional penicillin. We did not lose any babies of mothers so treated in pregnancy, as far as we know.

Cases of gonorrhea came to us most often because of sterility. As in the case of syphilis, we saw men who had taken as many as four wives in the hope of producing a child. Less commonly, the presenting symptoms and signs were of chronic pelvic inflammatory disease, and rarely did we see an acute case. In the villages this disease is treated with herbs and usually men seem fairly satisfied with the results. Diagnosis of gonorrhea tended to be made indiscriminately by the herbalist, so that it was necessary for us to do a lot of careful checking and sorting of the details of the history before making our diagnosis. We gave the same treatment as for syphilis to husband and wife simultaneously. We were a little surprised to find that women who had been sterile for years sometimes became pregnant within a few months of taking treatment.

FAMILY PLANNING

Sterility

In India, having a family is of paramount importance because of certain religious and social concepts as well as for security, especially in old age. It is, therefore, not surprising that sterility was a pressing problem in our clinic. During our second year in Barpali more than twenty cases a week consulted us, asking us to give them a child. We worked out a routine whereby the cases were first sorted out by a health worker who (1) sought a history of chronic malaria, (2) questioned and examined for signs of avitaminosis, (3) inquired about the possibility of gonorrhea, and (4) elicited the menstrual history. Malaria and frank avitaminosis were treated by the health worker, who also gave each woman a chart illustrating the monthly fertility cycle. Cases of venereal disease, menstrual irregularity, and other possibly pathological conditions were referred to the doctor. Gonorrhoea and syphilis were treated as described above. Other causes of ill health were sought and treated. With regard to menstrual irregularities, by far the most common type was scanty irregular periods delayed for intervals of a few days to months. In the absence of other demonstrable disease thyroid was given to these cases—$\frac{1}{2}$ grain daily for one to three months. In all cases dietary advice was given.

Results were startling, and it was no wonder that rumours of magic spread quickly through the villages. Adequate records during the initial stages of the clinic were impossible because of incomplete follow-up. Often we heard by rumour of the miracles achieved. Sometimes it would be revealed when a baby was brought to us, and the parents, expecting us to remember, would say, " You gave us this child." Of the much smaller number of successes that we were able to follow personally, we can only list the types of cases according to our impressions of their frequency. Most commonly the combination of anti-malarial drug with vitamins plus dietary advice was credited with favouring the pregnancy. This incidentally helped to boost the reputation of our health workers. A close second was treatment of venereal disease. We know a small number who seemed to owe the pregnancy to thyroid ; a few received no treatment aside from the fertility chart and dietary advice.

Some have questioned our enthusiasm for this work in the field of sterility in a country where over-population is already a serious problem. We can only say on humanitarian grounds that a childless home deserves a child wherever it may be. Also, the child so achieved is more likely to be adequately cared for than children of large families.

Birth Control

Although we were interested in the field of birth control from the beginning of the clinic, our opportunities were limited. At first we were sure that " rhythm " was the method of choice where cost and aesthetic considerations were important. Mostly women of more educated families consulted us at first, and it was not too difficult to make this method intelligible to them. When we tried to describe it to completely uneducated village women, however, we found that it was incomprehensible to people who cannot count and who are not trained to deduce abstract ideas from drawings or charts. Disadvantages of the method, then, were : (1) the difficulty in making it clear ; (2) the fact that more often it was only women and not the husbands who were interested in limiting the family ; (3) it did not appear to be efficacious enough when it was honestly tried to convince our health workers of its usefulness.

Following the realization that our first trial was a failure we began working in two directions. First was to make available commercial contraceptives to those who could afford them ; and second, to find a method which cost little or nothing for poor women who were demanding help. We decided against the use of a diaphragm because we felt that rubber products would perish quickly in the heat and also because we decided against trying to break down the barriers of shyness to teach women to handle the diaphragm accurately. We obtained " Preceptin " through Imperial Chemical Industries at their trade price of R. 4 (6/- or $0.80) per tube. Wealthy people did not mind trying it, but poor people could not undertake the repeated outlay of such a sum. We had two known failures with " Preceptin," among our regular attenders, one of which proved serious as the mother developed active tuberculosis during the pregnancy (her 11th).

For those who could not afford " Preceptin," we worked on the use of hypertonic salt solution as a spermicidal agent, following reading some reports on the subject. We decided to try using a rice paste as a base, but ran into the following difficulties : (1) making the paste was too much trouble for the women, and the paste would not keep because of the heat, (2) people had no faith in the use of such common ingredients, (3) our health workers could not give sufficient supervision to teach the woman the method in her home, (4) perhaps lack of privacy in the home also reduced its usefulness.

At the time we left the project, inquiry had been made into the use of " foam tablets " in projects in India and in birth control clinics in other parts of the world. This method seemed to answer many of our difficulties, and plans were made to use it in our clinic for all women desiring birth control. We had learned a number of lessons, the most important of which was expressed in a paper by Dr. CARL TAYLOR of Ludhiana Medical School — that acceptability of a method is just as significant as its efficacy when it is being offered as part of a public health programme.

The health workers have become increasingly interested in birth control and family spacing. Recently also there has been an increase in the number of patients seeking family planning advice.

General Considerations regarding Family Planning

The average family size in our area was just over four per family (living members). Histories in our maternal and child health centre, however, indicated that the average woman might expect to lose nearly half of her offspring. It is unnecessary to say that this cannot be regarded as a satisfactory method of population control. On the other hand we saw that very often the families of officials who were educated and financially solvent were very large, having ten to fifteen children, almost all surviving and healthy.

We believe that a programme in maternal and child health is not complete without an emphasis on family planning. Conversely, the family planning programme would be invalid in the absence of an effective maternal and child health service ; that is, a woman is not interested in limiting her family until she can be reasonably sure of the survival of the ones she has. We found that women in our clinic showed an increasing interest as they perceived the idea of preventive measures in child bearing and child care.

EXCERPT

ACUTE RHEUMATIC FEVER IN JAMAICAN CHILDREN

(E. H. BACK AND E. E. DEPASS. *West. Ind. med. J.*, 1957, 6, 98)

Forty-four cases of acute rheumatic fever in children admitted to the University College Hospital over four years are reviewed. The disease is not uncommon in Jamaica and its symptomatology in general is similar to that found in temperate climates. Chorea was rare in the series reported while noudles and erythema marginatum were not seen. The disease affects slightly younger age groups than in temperate climates and is severe with a high mortality and high incidence of cardiac complications.

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EDITORIAL

MENINGITIS IN YOUNG CHILDREN

Few statistics are available concerning the incidence of non-tuberculous meningitis in young children in the tropics. This is partly because of the notorious difficulty in making a clinical diagnosis, especially in the first months of life, and the absence of facilities for bacteriological diagnosis in most areas, but mainly, perhaps, because of the lack of actual reports from children's units in the tropics.

A recent account by SENECAL, DUPIN and CHARPENTIER of 202 cases of non-tuberculous acute bacterial meningitis in young African children below three years of age admitted to the Hôpital Central Africain in Dakar is, therefore, of considerable interest.(1)

In particular, bacteriological examination of the cerebrospinal fluid showed the following results : *Haemophilus influenzae* 39 per cent., pneumococcus 19 per cent., meningococcus 13 per cent. and other organisms 5 per cent. The infecting bacteria were unidentified in 24 per cent. of cases.

These findings are important in that they very much parallel the high incidence of *H. influenzae* and pneumococcal meningitis in this age-group in the temperate zone. In addition, similar results have been observed in Madras in southern India (S. T. ACHAR — personal communication) and in Jamaica — so that it may well be that these forms of meningeal infection are significant, almost age-specific problems in young children in much of the world.

The high incidence of meningitis in which the responsible bacteria could not be determined in the Dakar series, again showing similarity to experience elsewhere, may be primarily due to treatment having been initiated with sulphonamides and antibiotics prior to admission to hospital ; while the possibility and identifying organisms may be considerably reduced in children showing a good cellular response, when few bacteria are present among large numbers of polymorphs.

As pediatric facilities improve in tropical regions, meningitis in this age group will certainly be found to be a not uncommon problem. Therapy poses certain difficulties, especially in view of the high percentage of cases with uncertain bacteriology ; while, even if full laboratory facilities are available, there may be a period of delay before a specific diagnosis can be made, possibly based on cultures of the offending organism. It is, therefore, wisest to initiate chemotherapy with a wide spectrum of drugs, and a triple combination often favoured consists of sulphadiazine, penicillin and chloramphenicol. All these can be given parenterally for the initial dose, if considered necessary, and can be so continued until the child can retain drugs given orally, when the chloramphenicol and sulphadiazine can be given by mouth. When, and if, bacteriological identification of the specific organism has been made, chemotherapy can be changed accordingly, preferably guided by laboratory sensitivity tests.

However, as stressed by SENECAL and his colleagues, a most important prognostic consideration is early diagnosis and treatment. It does seem, therefore, that the tropical pediatrician should have a high index of suspicion for this often insidious and frequently fatal group of infections.

(1) Sénécal, J., Dupin, H. and Charpentier, P. (1957). *Bull. méd. de l'A.O.F.* **2**. 241. A propos de 202 cas de méningites aiguës du nourisson.

PERSPECTIVES OF SICKLE-CELL DISEASE

by

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The contributions to the nosography and scientific study of sickle-cell disease, from the time of Herrick's original description in 1910 to the year 1951, have been comprehensively reviewed in the papers of Margolies (1951) and of Leavell and MacIlwaine (1952). The information accruing from the scientific studies of late years, however, has broadened the dimensions of nosography to such an extent that it has become impracticable to describe sickle-cell and related diseases within the limits of a single article. Fortunately, the publication of editorials and of excellent review papers has kept pace with the various advances in knowledge. Hence, although some repetition is inevitable, the present authors' purpose is to delineate broadly the aspects of sickle-cell disease that have a particular bearing upon clinical tropical practice, referring the reader to those papers in which the subject matter is treated in detail. The rapid advance in knowledge is essentially the record of the astonishing success which has attended the development and application of the techniques of the biochemist, physical chemist, geneticist, and anthropologist. A brief examination of their respective fields of study lends perspective to the whole.

PHYSICO-CHEMICAL PERSPECTIVE

The demonstration of sickling by means of the addition of chemical reducing agents to whole blood *in vitro* has proved invaluable. Many reducing agents have been employed (Leavell and MacIlwaine, 1952) and the most useful, because of its relative stability, is sodium metabisulphite ($Na_2S_2O_5$) (Daland and Castle, 1948). The cells of sickle-cell anaemia appear filamentous and elongated when sickled, whereas those of sickle-cell trait tend to assume a holly-leaf shape. Filamentous forms have also been found in sickle-cell/thalassaemia and sickle-cell/Hb-C disease (Smith, 1957). This lack of uniformity in appearance of the erythrocytes was made use of by Neel (1951) in the course of his genetic studies.

The discovery, in sickle erythrocytes, of a haemoglobin (Hb-S) differing in its electrophoretic mobility from that of normal erythrocytes (Hb-A), was of fundamental importance (Itano and Pauling, 1949 ; Pauling et al., 1949). It was found that sickle-cell anaemia erythrocytes contained Hb-S, but did not contain Hb-A, whereas sickle-cell trait erythrocytes contained a mixture of Hb-S (24-45 per cent.) and Hb-A. Pauling and his colleagues used the moving boundary electrophoresis (Tiselius) apparatus which is expensive, and available only to a few laboratories. Spaet (1953) demonstrated that the haemoglobins could be separated by the simple method of filter paper electrophoresis, and this technique has now been adopted in laboratories throughout the world for diagnostic purposes.

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This method has also made possible the collection of data pertaining to the geographical incidence of the abnormal haemoglobins. A simple and inexpensive filter paper apparatus has been described by BERGREN, STURGEON, and ITANO (1954).

The other physical properties of haemoglobin have been investigated ; solubility, and resistance to alkali denaturation, have been proved to be of great significance and may readily be determined. PERUTZ and his colleagues observed that whereas Hb-A in its reduced state possesses half the solubility of Hb-A in its oxygenated state, Hb-S in its reduced state possesses only one-hundredth the solubility of oxygenated Hb-S (PERUTZ and MITCHISON, 1950 ; PERUTZ, LIQUORI, and EIRICH, 1951). Moreover, HARRIS (1950) found that concentrated sickle-cell haemoglobin solutions upon reduction formed gels, which were found on microscopic examination to be composed of " tactoids," viscous structures whose shape resembled that of sickled cells. ITANO (1953a) has described a rapid method whereby the solubility of haemoglobin may be determined, and has demonstrated its value in the recognition of the rare Hb-D. The electrophoretic mobility of Hb-D is identical with that of Hb-S, but the solubility of reduced Hb-D is approximately the same as that of reduced Hb-A. However, since this particular procedure requires the use of an ultra-centrifuge, its adoption has been restricted.

An important contribution was that of SINGER, CHERNOFF, and SINGER (1951) who found that sickle-cell anaemia erythrocytes contained, in addition to Hb-S, an alkali-resistant haemoglobin which resembled foetal haemoglobin (Hb-F). By immunological methods its apparent identity with foetal haemoglobin obtained from cord blood was established by GOODMAN and CAMPBELL (1953). Sickle-cell anaemia erythrocytes contain 5-15 per cent. Hb-F whereas sickle-cell trait cells, like normal adult erythrocytes, contain less than 2 per cent. Hb-F. Hb-F is found in the erythrocytes in other severe anaemias, particularly in thalassaemia, in which condition all of the haemoglobin may be Hb-F. The " one-point " alkali denaturation technique of SINGER et al. requires little apparatus, and is simple to perform.

These techniques have been fully described by a number of authors, particularly by SINGER (1955), CHERNOFF (1955), and ITANO, BERGREN, and STURGEON (1956). By their application a number of human haemoglobins were quickly described, and a system of nomenclature became necessary. Such a system was proposed by several of the outstanding contributors to this field of knowledge (vide *Blood*, 1953, vol. 8, p. 386), and has been generally adopted. According to this plan, each haemoglobin has been given an alphabetical designation in the order of its discovery, with several exceptions designated alliteratively for convenience. The haemoglobins described to date and designated serially are C, D, E, G, H, I, J, K, and L. Those specially designated are haemoglobins A (adult haemoglobin), F (foetal haemoglobin), M (the haemoglobin of congenital methaemoglobinaemia, HÖRLEIN and WEBER, 1948), P (primitive haemoglobin of the embryo, ALLISON, 1955*), and S (sickle haemoglobin). The physical and biochemical characteristics of the varieties of human haemoglobin have been fully discussed by ITANO (1953b), ROCHE and DERRIEN (1953), WHITE (1953), PAULING (1954), WHITE and BEAVEN (1954), SINGER (1955), CHERNOFF (1955), ITANO et al. (1956), and ITANO (1956).

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* Halbrecht and Klibanski (1956) have identified another haemoglobin in the blood of a ten-week embryo.

GENETIC PERSPECTIVE

EMMEL (1917) noted that sickled erythrocytes were present in the stained blood smears of his patient, and that the erythrocytes of her father's blood, although normal in stained smears, became sickle-shaped when allowed to stand in a moist-slide preparation. No further reference was made to the possibility of inheritance of the phenomenon until the year 1923, when HUCK, TALIFERRO and HUCK, and SYDENSTRICKER et al., examined several families and noted that sickling occurred in three generations ; some members with sickling suffered from severe anaemia ; other members were apparently healthy, yet their erythrocytes also possessed the ability to sickle. These authors concluded that the condition was inherited as a single dominant factor with variable expression. No essential difference was made between the milder and more severe forms, and this view of the hereditary nature of the disease was held until 1947, when NEEL suggested that the mild disease might represent a heterozygous state in which a single gene is inherited, and the severe disease a homozygous state in which the genes are inherited from both parents. This hypothesis was substantiated by studies of the kindreds of affected individuals, carried out independently by BEET (1949) in Africa and by NEEL (1949, 1951) in the United States. Moreover, NEEL's hypothesis was corroborated when PAULING and his colleagues discovered that sickle-cell trait erythrocytes contained both Hb-S and Hb-A, whereas sickle-cell anaemia erythrocytes contained Hb-S but no Hb-A.

In so far as genetic investigation has been carried out, the majority of the abnormal haemoglobins appear to be inherited in a similar fashion. So, too, for the inheritance of thalassaemia, but in this case the genes determining thalassaemia do not give rise to an abnormal haemoglobin ; the thalassaemia genes appear to suppress the synthesis of Hb-A while permitting the synthesis of Hb-F. However, since a number of abnormal haemoglobins have been described in addition to Hb-S, and since an individual may be simultaneously heterozygous for different abnormal haemoglobins, (or for thalassaemia and an abnormal haemoglobin), the task of unravelling the genetic patterns of inheritance is one of considerable difficulty. In part, this difficulty is due to the paucity of data concerning several of the newly-described haemoglobins, and in part to the relative rarity of individuals simultaneously heterozygous for more than one haemoglobin. It is due also to the variable expressivity of these haemoglobins ; in the sickle-cell trait individual, for example, the proportion of Hb-S present may vary from 24-45 %.

Since it is feasible to determine the relative proportions of the haemoglobins present in the blood of a given individual, the degree of expression of the respective genes can be estimated quantitatively — for the human geneticist this is a circumstance both unique and opportune.

CHERNOFF (1955) examined the proportions of the haemoglobins found in the various syndromes and advanced a working hypothesis concerning the modifying effect of one haemoglobin upon another. Although CHERNOFF admitted that it is to some extent speculative and although it probably errs through over-simplification this hypothesis is a very useful contribution. In a heterozygote, Hb-A occurs in larger amount than does any of the abnormal haemoglobins. In the simultaneously heterozygous condition, sickle-cell/Hb-C disease, Hb-S and Hb-C occur in approximately equal amounts but frequently Hb-C is found in slightly greater amount than Hb-S. Hence it may be concluded that the Hb-A gene possesses a degree of dominance over the genes for the abnormal haemoglobins, and that the Hb-C gene is slightly dominant over the Hb-S gene when these are found together. Hb-F is suppressed whenever Hb-A is present, and from quantitative determinations CHERNOFF concluded that of the haemoglobins Hb-A is the most potent inhibitor of Hb-F ; Hbs-C, -D, and -E, are less potent, and Hb-S least of all. Further, in an individual heterozygous for more than one haemoglobin the degree of suppression of Hb-F is determined by the more potent inhibitor of the combination. Thalassaemia, however, exerts a converse effect. In simultaneously heterozygous conditions in which thalassaemia is associated with one of the variant haemoglobins the variant gene is dominant ; in these cases Hbs-S, -C or -F may amount to 60-80 per cent. On the other hand, when thalassaemia is found in association with Hb-A, the normal Hb-A may be suppressed.

ITANO (1953c) suggested that the genes controlling Hbs-C, -S, and -D, were alleles of the gene controlling Hb-A, occurring at the same chromosomal locus. EDINGTON and LEHMANN (1955) extended the series to include Hbs-E and -G. NEEL (1956, 1957) discussed this multiple-allele hypothesis and was unable to accept it in its entirety. The genetic data concerning Hbs-D, -E and -G are too scanty to permit satisfactory conclusions, and for the present NEEL found it necessary to postulate three genetic loci determining haemoglobin synthesis. At the first locus Hbs-A and -G are alleles ; and at the second locus Hbs -A and -G are alleles ; and at the third locus Hb-A and the thalassaemia gene are alleles. For a fuller discussion of the genetic problems the reader is referred to the papers cited above, and to ZUELZER et al. (1956).

EPIDEMIOLOGICAL PERSPECTIVE

While yet incomplete, information concerning the world-wide incidence of the abnormal haemoglobin is being rapidly accumulated, and it is already apparent that these haemoglobins are distributed in a curiously patchy manner. More is known of the incidence of Hb-S than of the other haemoglobins not only because Hb-S was the first variant to be recognized but because sickling of the erythrocytes provides a ready means for the detection of Hb-S. Amongst Negroes in North America the frequency of Hb-S is approximately 9 per cent. (HAYNIE et al., 1957). In Africa, where sickling is found mainly in the Bantu, and the Nilotic and Sudanese Negroes, the frequency varies from 2-40 per cent. (MOURANT, 1954). In Europe, Hb-S is found in southern Italy, commonly associated with thalassaemia in the simultaneously heterozygous condition, microdrepanocytic disease (SILVESTRONI and BIANCO, 1952). DELIYANNIS and TAVLARAKIS (1955) found Hb-S occurring with a frequency varying between 6 per cent. and 32 per cent. in different and isolated villages in northern Greece, and AKSOY (1955) found Hb-S occurring with a frequency of 13.3 per cent. in southern Turkey. LEHMANN (1954) found Hb-S in southern Arabia, and LEHMANN and CUTBUSH (1952) found Hb-S occurring, with a frequency varying from 3.3 to 30 per cent. in different communities, amongst the aboriginal Veddoids of southern India. FOY et al. (1956) have reported sickling in some of the aboriginal peoples of the Central Provinces in India ; the incidence apparently is variable and is surprisingly high (55 per cent.) in one group, the Parjah Khonds. DUNLOP and MOZUMDER (1952) found sickling among Behari labourers employed on the tea gardens of North Assam.

Hb-C occurs in Negroes of North America with a frequency of approximately 2 per cent. (HAYNIE *et al.*, 1957). Apart from occasional reports from elsewhere in Africa, Hb-C occurs mainly in West Africa. This haemoglobin variant was found with a frequency of 28 per cent. among the Dagomba of the northern Gold Coast. In the southern

Gold Coast a frequency of 10 per cent. was found, and in the Yoruba of West Nigeria a frequency of 7 per cent. (EDINGTON and LEHMANN, 1954a, LEHMANN, 1956).

Hb-D was first described in the United States (ITANO, 1951), and, apart from a few reports from Europe and Turkey (WHITE and BEAVEN, 1954 ; AKSOY and LEHMANN, 1956), appears to occur mainly in North India where BIRD and LEHMANN (1956) found an incidence amongst Sikhs of approximately 3 per cent., and amongst Gujeratis of 1 per cent.

Hb-E was described in the United States (ITANO et al., 1954) in a child of mixed (Hindu) ancestry, but appears to occur most commonly in South East Asia. NANAKORN et al. (1954) found Hb-E occurring with a frequency of 12.5 per cent. in Thailand, where it is commonly associated with thalassaemia. In Indonesians Hb-E was found to occur with a frequency of 3.6 per cent. (LIE-INJO LUAN ENG, 1955), in the Veddas of Ceylon with a frequency of 3.6 per cent. (AKSOY et al., 1955), and in the Burmese with a frequency of 15 per cent. (LEHMANN et al., 1956). CHATTERJEA et al. (1956) have also found Hb-E in Bengalis.

Hb-G was described in Africa (EDINGTON and LEHMANN, 1954b), and in an Italian family in the United States (SCHWARTZ and SPAET, 1955).

Hb-H has been found in a Chinese family living in Oregon, in Filipinos, in Thais, in one Malayan, in two Greek families, in a Greek Cypriot, and in a Jordanian Arab (RIGAS et al., 1955 ; MOTULSKY, 1956 ; NANAKORN, 1956 ; LEHMANN and SINGH, 1956 ; GOUTTAS et al., 1955 ; AGER and LEHMANN, 1957a). Hb-H does not appear to be inherited and is commonly associated with thalassaemia. MOTULSKY (1956) suggested that thalassaemia activates the expression of Hb-H.

Hb-I was found in a Negro family in the United States and in Algeria (PAGE et al., 1955 ; CABANNES et al., 1955). Hb-J, first described in an American Negro, has also been found in West Africa, in a French Canadian family, in an Indonesian family, and in a Gujerati (THORUP et al., 1956 ; ROBINSON et al., 1956 ; HUISMAN et al., 1957 ; RAPER, 1957).

Hb-K has been found in Kabyles and Liberians and Dagombas in Africa, and in an Indian family (CABANNES et al., 1956 ; ROBINSON et al., 1956 ; AGER and LEHMANN, 1957a). Hb-L was found in a Punjabi Hindu (AGER and LEHMANN, 1957b).

It is therefore clear that the abnormal haemoglobins, with some reservation in the case of Hb-D, occur among the inhabitants of tropical and sub-tropical zones (NEEL, 1956), and in their descendants elsewhere. Although a controversial matter, many authors consider Hb-S an African variant that is also found amongst certain people in whom admixture of African blood may have occurred, perhaps centuries ago. Hb-C is likewise an African variant. Hb-D is found mainly in northern India, and Hb-E in South East Asia. LEHMANN et al. (1956) have suggested that the occurrence of Hb-E in South East Asia may be of equivalent significance to that of Hb-S in Africa. It seems evident too that the distribution of these haemoglobin variants, within the areas mentioned, is peculiar to smaller communities and villages, and it is probably not without significance that many of these communities are aboriginal or primitive, and remote by reason of geography or custom.

Moreover, the incidence of the Hb variants in these enclaves is sometimes phenomenally high. In the case of Hb-S, for example, NEEL (1956) has pointed out that since the homozygous condition, sickle-cell anaemia, is commonly fatal or seriously disabling, many of the Hb-S genes in a community must die out ; and it has become a matter of considerable medical interest to explain how the incidence of Hb-S is maintained. Since these are virtually closed communities two hypotheses might be entertained, namely, that the members of the community are themselves different, and that the environment is peculiarly responsible. The first hypothesis requires that the Hb genes undergo mutation at much greater rate than has hitherto been suspected in man, and that the loss of genes through the homozygotes is balanced by the heterozygotes possessing greater effective fertility than the remainder of the population whose haemoglobin is only normal ("balanced polymorphism "). The second hypothesis entails a search for peculiar environmental factors promoting a balanced polymorphism, and so far this search has been directed mainly toward the malaria parasite. HALDANE (1949) had suggested that the high incidence of thalassaemia in some communities might be accounted for if the thalassaemia trait individual were less susceptible to malaria than is the normal individual. ALLISON (1954) presented evidence for a similar explanation of the high incidence of sickling encountered in some parts of the world. ALLISON'S contention was supported by RAPER (1955) who found that parasite counts (*P. falciparum*) were very much lower in sickling than in non-sickling children. RAPER examined children under two years old and concluded that, although it did not prevent infection, the presence of Hb-S in the erythrocytes limited the severity of *P. falciparum* infections in non-immune subjects. Non-immune children are those most likely to die from malaria. Thus it appears probable that malaria is a factor promoting the high incidence of sickling This interesting question was discussed fully by NEEL (1956, 1957), who rightly suggested that further information be collected, particularly concerning the comparative incidence of sickling in those dying from malaria (for example in a series of cases of cerebral malaria), the distribution of Hb-S according to age, the types of marriages with respect to the sickle-cell gene, and the fertility of these marriages.

CLINICAL PERSPECTIVE

The studies indicated above have added new dimensions to the nosography of sickle-cell disease, and at the same time have opened up a new nosological category that includes sickle-cell and related diseases, conditions " in which the production of normal adult haemoglobin (Hb-A) is partly or wholly suppressed and is partly or wholly replaced by one or more haemoglobin variants, which may include foetal-type haemoglobin (Hb-F)." These conditions were collectively designated the " hereditary haemoglobinopathies " by MOTULSKY (1954), and the definition quoted above is that of a Working Party of the Colonial Medical Research Committee (vide *Lancet*, 1957, vol. I, 1084). This body has proposed for the haemoglobinopathies a system of terminology which has the merit of practical simplicity and which has been adopted in this article.

In general, the haemoglobinopathies manifest themselves as haemolytic disorders and as refractory anaemias, the homozygote as a rule being severely affected, and the heterozygote frequently being clinically unaffected. SMITH and CONLEY (1954) drew attention to differences between the clinical features and course of the homozygous condition, sickle-cell anaemia, and those of the simultaneously heterozygous conditions, sickle-cell/Hb-C disease and sickle-cell/thalassaemia. The variant disorders were milder, anaemia being less marked, crises less frequent, and leg ulcers rare. On the other hand, target cells were more commonly present and splenomegaly persisted into adult life. SMITH and CONLEY encountered aseptic necrosis of the head of the femur, haematuria, and complications during pregnancy, more commonly in sickle-cell/Hb-C disease ; in our experience, however, aseptic necrosis of the head of the femur has occurred more commonly in sickle-cell anaemia. The bodily habitus of the patient with the variant disorder was found to be generally stockier than that of the patient with sickle-cell anaemia. The clinical and haematological manifestations of the various haemoglobinopathies have been described by SINGER (1955), CHERNOFF (1955), FERGUSON et al. (1955), ITANO et al. (1956), ZUELZER et al. (1956), and SMITH (1957).

It is important to note that the majority of the patients described by SMITH and CONLEY as having sickle-cell/Hb-C disease had been considered earlier to have " atypical " sickle-cell anaemia. The discovery of the haemoglobin variants and the present genetic knowledge have done much to clarify the " atypical " cases and their apparently inconstant severity. It is now realized that the homozygous condition, sickle-cell anaemia, is a uniformly severe disease, perhaps becoming less severe in those who reach adulthood, but varying little from one patient to another. Its course alters little, apart from the occurrence of crises ; and the haemoglobin level is remarkably constant, commonly 6 to 8 gm. per 100 ml. CROSBY and AKEROYD (1952) have estimated the marrow's capacity to compensate for excessive red cell destruction, and have concluded that erythropoiesis may be increased to a level 7 or 8 times that which is normally adequate. In a patient with sickle-cell anaemia, erythropoiesis at its fullest is unable completely to compensate for the destruction of red cells. Hence the patient remains anaemic, and the marrow no longer has any reserve capacity. SINGER et al. (1950) described three types of crisis, the hyperhaemolytic, the aplastic, and a combination of the two. The hyperhaemolytic crisis occurs when for some reason the rate of haemolysis is increased with the result that the anaemia becomes even more severe. We have observed (PATERSON and SPRAGUE, to be published) that, in sickle-cell anaemia, fever alone may cause excessive haemolysis, and have suggested that this is due to excessive sickling brought about by the increased utilisation of oxygen. In the aplastic crisis, erythropoiesis is depressed with the result that the haemolytic process is no longer even partially compensated. Inhibition of erythropoiesis has followed infections, virus pneumonia, infectious mononucleosis, and *S. choleraesuis* infection (SINGER et al., 1950 ; CHERNOFF and JOSEPHSON, 1951). SINGER'S third type of crisis takes the form of a combination of hyperhaemolysis with inhibition of erythropoiesis. In recent years attention has been paid to a fourth type, designated the thrombotic, infarctive, or painful crisis. This takes the form of bone and joint and abdominal pain, often with fever and leucocytosis, but without any further lowering of the haemoglobin level. An explanation of the manner in which these crises occur derives much from the observations of HARRIS et al. (1956), who noted that the consequences of sickling are increased mechanical and osmotic fragility of the erythrocytes, a lowering of the blood *p*H, and an increase in the blood viscosity. This last effect, where the blood flow is not great, tends to produce erythrostasis and " thrombotic " episodes, thereby promoting further sickling.

Some inherited disorders can be substantially corrected, but for others the best that may be accomplished at present is the maintenance of the general health and the state of nutrition. Sickle-cell disease is of the latter, although the authors have noted greater longevity of the red cells, higher levels of haemoglobin, and fewer crises, following splenectomy (SPRAGUE and PATERSON, to be published).

There are two principal procedures in the treatment of crises, viz., lowering the fever and transfusion of blood. The first, which also implies prompt and specific treatment of infections, is indicated since, as was stated above, fever alone may intensify the sickling process. MARCHAND (1955) has drawn attention to the antipyretic effect of morphine, and a trial of this drug in painful crises associated with fever would seem worthwhile. Perhaps, too, chlorpromazine is worthy of trial in the crises of sickle-cell anaemia, recognising that its use may be limited because of its hepato-toxic effects. Blood transfusion is necessary in hyperhaemolytic and aplastic crises, and small transfusions are often very effective in painful crises. It is logical both to increase the oxygen-carrying capacity of the blood and to dilute the sickle erythrocytes with normal erythrocytes. Smith et al. (1953) have reported favourably on the use of priscoline, a vasodilator, and Greenberg and Kass (1956) have administered alkali for the relief of painful crises. By raising the blood *p*H, the oxygen dissociation curve is shifted so that more oxygen is retained by the haemoglobin at low oxygen pressures. Anti-coagulants have not proved useful. Oxygen is commonly administered to patients in crisis with little evidence that it is helpful, and some reason to suspect that it may be harmful if used in high concentration, since it is well established that oxygen administration depresses erythropoiesis (Reinhard et al., 1944 ; Tinsley et al., 1949).

For the future, genetic knowledge suggests the means whereby much human unhappiness may be obviated. In 1947 Neel rightly advised great caution in the advocacy of genetic control for diseases of which knowledge was still limited. Through the efforts of Neel and others during the past ten years this last condition has been largely met, insofar as sickle-cell disease is concerned. The proper investigation of sickle-cell disease includes study of the patient's relatives ; it may not now be improper to offer counsel concerning the hereditary nature of the disease.

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BOTTLE FEEDING : A PROBLEM OF MODERN CIVILIZATION

by

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Until quite recently breast feeding was accepted by African mothers as the only means of rearing their babies. It has now become a common sight in Uganda to see an African baby being fed, often by an older child, with various mixtures of milk, cereal or tea from a bottle. The dangers of this practice are obvious.

It is probable that indiscriminate bottle feeding will become a problem in any part of the world where there are shops at which infant feeding bottles and teats can be purchased. In Malaya it has been a problem for many years. Ten years ago WILLIAMS (1946) deplored the frequent use of diluted sweetened milk for bottle feeding by Chinese women in Malaya. More recently THOMPSON (quoted by JELLIFFE, 1955) remarked that it was becoming fashionable among Malay women to give small drinks of sweetened condensed milk on grounds that the mother's milk was inadequate.

Other writers have referred in passing to the occurrence of similar problems in Africa. LONGMORE (1954) mentioned that in South African towns many babies were artificially fed (usually with a locally produced patent baby food) throughout the day while their mothers were at work. BELL (1955) mentioned that it was becoming fashionable among less educated members of Kenya tribe — the Ameru — to offer feeds of raw milk or tea from a bottle. LAMBOTTE-LEGRAND (1955) referred to failure of lactation as an increasing problem in the Belgian Congo.

Most writers, however, prefer to dwell upon the satisfactory capacity for lactation possessed by most African women. JELLIFFE (1955) in a review of infant feeding in the tropics, made practically no reference to bottle feeding as a problem, although he stressed the present trend away from breast feeding. In most parts of Africa it is assumed that a child will be fully breast fed for six months or so and breast feeding often continues to make an important contribution to a child's diet for several years. Indeed, there is much to be thankful for. Commercial firms have on the whole been very good about refraining from exploiting the African market. Bottle feeding has been used intelligently by many African families to rear children who would otherwise have died of starvation. It is only very recently that there has been a tendency among less educated African families to buy infant feeding bottles and use them wrongly.

The present paper is a review of the incidence of bottle feeding during the past five years, its possible causes and its effects among African children of a relatively advanced and well-educated tribe, the Baganda, living near Kampala, Uganda.

THE CHILDREN STUDIED

Child welfare clinics have been held for the past six years at various centres in the villages near Kampala. The following findings are based on information contained in the record cards of children attending these clinics during 1950 and 1955. In order to compare the numbers of children being bottle fed in 1950 and 1955, a count was made of all cards of children who were observed for six months, regardless of whether the family and social history was fully recorded. More detailed information was needed about the family circumstances of children who attended in 1955. This information was obtained from the cards of children aged under two years who attended in 1955.

The cards were classified into the following groups :

1. Highly educated families (mainly graduates or secondary school teachers).
2. Ordinary families (slightly educated or uneducated).

(a) Those who were breast fed for six months and never bottle fed (B) ; (b) Those who were given supplementary bottle feeds before the age of six months, excluding twins (S) ; (c) Twins ; (d) Orphans.

FINDINGS

Incidence of bottle feeding. The following results were obtained from a count of all cards of children who were observed for six months, whether fully completed or not, from which the relevant data could be obtained. This count included the cards of orphan children and twins. Children of highly educated families were treated as a separate group.

TABLE I. Bottle feeding and weaning in uneducated or slightly educated Baganda families in 1950 and 1955, and in highly educated families in 1955.

	1950	1955	1955 (Highly educated)
Number of children	223	285	41
Supplementary bottle feeds before 6 months old	31 (14%)	97 (30%)	11 (27%)
Completely weaned from breast before 6 months old	7 (3%)	12 (4%)	2 (5%)
Supplementary bottle feeds before 1 month old	4 (2%)	15 (5%)	1 (3%)
Completely weaned from breast before 1 month old	2 (0.9%)	4 (1.4%)	0 —

Table I shows that the number of children who were offered supplementary bottle feeds increased considerably between 1950 and 1955. Most of the children who were bottle fed were also still being breast fed.

Duration of breast feeding. No change was noted between 1950 and 1955 in the average age for final weaning from the breast, which was usually completed about twelve months. Among highly educated families, it was customary to complete weaning rather earlier, at about nine months. Supplementary bottle feeding was nearly always followed by early weaning.

Reasons for bottle feeding. Among social circumstances which might encourage bottle feeding, information was available about the educational level and condition of life of the family, whether living in the town or country, and whether the parents were living together or separately (Table III).

TABLE II. Duration of breast feeding among fully breast fed children in 1955 (1955 B), supplementarily bottle fed children in 1955 (1955 S), children of highly educated families in 1955 and children in 1950

	1955 B	1955 S	1955 Highly educated	1950 B + S
Number of children from which information available	141	37	35	58
Average duration of breast feeding (months)	12.7	6.6	8.9	11.8
Shortest duration of breast feeding	6.5	0.25	1.6	1.0
Longest duration of breast feeding	24.0	13.0	12.0	19.0

TABLE III. Comparison of social circumstances of children who were fully breast fed (B) and those who were supplementarily bottle fed (S).

	S	B
Number of boys	33	168
Number of girls	42	117
Total number of children	75	285
Number of families	75	270
Slightly educated families	39 (52%)	162 (60%)
Living in town or peri-urban belt	20 (27%)	82 (30%)
Parents separated	15 (20%)	53 (20%)

Practically all the children studied had at least one literate parent. Children of the most highly educated families were not included in this table. " Slightly educated " families were those in which the father worked as a clerk or in some skilled occupation and the mother had spent at least three years in primary school. Table III shows that the effect of education on breast feeding was, if anything, favourable. In the group of children who were supplementary fed, 62 per cent. of the families were slightly educated, while, in the group who were fully breast fed, 60 per cent. of the families were slightly educated. This was also illustrated in Table I which showed that there was no increased tendency to bottle feed among the highly educated families. Highly educated mothers were usually very anxious to breast feed for at least six months ; mixed feeding was usually started at four to five months and weaning was completed about nine months along the lines suggested in English books on mothercraft.

The proportion of children living in the town or peri-urban belt was similar in both groups. All the children studied lived within twenty miles of Kampala and all had their roots in the village.

A high proportion of children in both groups came from broken homes in which the parents were separated. There was no difference in this respect between the supplementarily fed and breast fed children.

The reasons for bottle feeding in the individual children studied are shown in Table IV.

Twins. During the period under review, 19 pairs of twins attended the clinics. Of these seven children died at birth or within the first few weeks of life. All the twin children except one were supplementarily bottle fed from soon after birth. The child who was

TABLE IV. Reasons for offering supplementary bottle feeds.

Total number of children	75
Mother ill (2 mastitis, 2 ill after confinement)	4
Baby ill (2 chronic malaria, 1 cardiac defect, 1 mental defect, 1 cleft palate)	5
Prematurity	8
Advised at clinic or hospital	9
Did not ask for advice ; supplement probably necessary	8
Did not ask for advice ; supplement probably unnecessary	41
Note. This group does not include twins (31 surviving children) and orphans (11 children)	

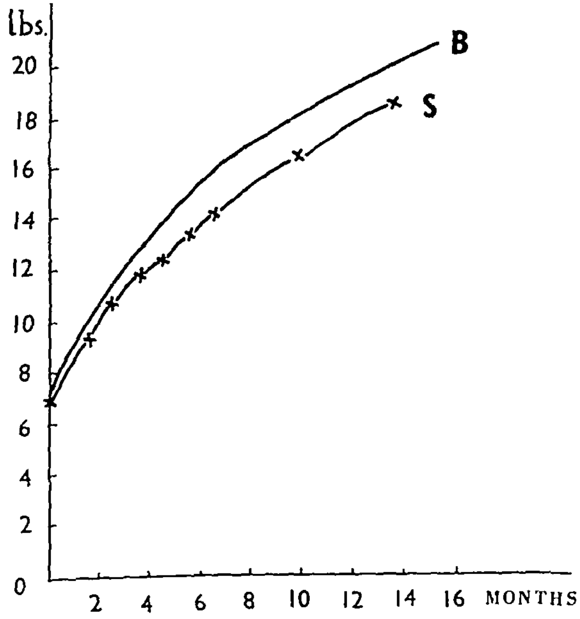

FIG. 1. Mean weights at different ages of supplementarily bottle fed Baganda children (S) compared with the mean weights of all Baganda children (B) during 1955.

fully breast fed and one other were well above the average weight for their ages. The others were 3 - 4 lb. below the average weights for Baganda children of the same ages from 6 - 14 months. One twin child developed kwashiorkor.

Orphans. Children who had to be separated from their mothers at birth were reared on the bottle by grandparents or other relatives. During the period under review, eleven such children were seen — eight were artificially reared because the mothers died during or soon after confinement ; one because the mother was mad ; and two were illegitimate children whose mothers were engaged to be married. The two illegitimate children had excellent grandparents who reared them very successfully. The remaining children were all underfed and in poor condition when first seen. Two of the mothers were known to have died of tuberculosis. Nothing is known of their ultimate progress, because none of these children were brought to clinics for more than a few weeks.

Effects of bottle feeding.

In order to assess the effects of supplementary bottle feeding the two groups were once more compared. The accompanying graph shows the mean weights at different ages of the supplementarily fed children compared with the mean weights of the same ages of all Baganda children weighed at child welfare clinics in 1955 (Fig. 1). It shows

TABLE V. Diarrhoea and respiratory infection among children who were fully breast fed (B) and those who were supplementarily bottle fed (S).

		S	B
1 - 6 months	Number of visits to clinic	257	1137
	Diarrhoea or vomiting	26 (10%)	34 (3%)
	Acute respiratory infection	46 (18%)	120 (10%)
6 - 12 months	Number of visits to clinic	166	1086
	Diarrhoea or vomiting	19 (11%)	66 (6%)
	Acute respiratory infection	39 (24%)	153 (14%)

TABLE VI. Blood examinations in children who were fully breast fed (B) and those who were supplementarily bottle fed (S).

	S	B
Number of blood slides examined, aged 6 - 12 months	90	126
Number of slides in which parasites were found	14 (15.6%)	23 (13%)
Number of haemoglobin estimations (Tallquist) in children aged 6 - 12 months with no malaria	24	297
Average haemoglobin level	79%	75%

that the supplementarily fed children were 1 - 2 pounds lighter than the average for Baganda children at all ages from 4 - 14 months. Table V shows that the children who were bottle fed were more prone to respiratory infections and diarrhoea than those who were fully breast fed. Table VI shows that no significant increase in susceptibility to malaria could be demonstrated among the bottle-fed children. Nor could it be shown that bottle feeding produced any tendency towards anaemia.

DISCUSSION

Lactation and civilization. Under conditions of modern civilization, bottle feeding is frequent because it is easy and successful. Surveys in England (NAISH, 1948 ; HUGHES, 1948; ROBINSON, 1951 ; and WESTROP, 1953) have shown that 40 to 60 per. cent of children are weaned from the breast by the time they are three months old. Away from modern civilization bottle feeding becomes much more difficult and breast feeding much more successful. In prisoner of war camps WILLIAMS (quoted by JELLIFFE, 1955) found that practically all European mothers were able to rear their babies successfully on the breast. Until recently milk and feeding bottles were unavailable in Africa. JELLIFFE (1955) saw no cases of failure of lactation, apart from severe illness or disease of the breast, in four years in West Africa. With the advent of industrial civilization and shops selling feeding bottles and baby foods it is to be expected that the picture in Africa will change.

Reasons for starting bottle feeding. Reasons for starting bottle feeding usually fall into one of the following groups : (a) *Physical causes :* Illness or abnormality of the baby ; death or severe illness of the mother ; disease of the breast ; (b) *Failure of lactation :* the baby is underfed on the breast ; (c) *Personal causes :* fear of underfeeding ; interests or work outside the home.

In England physical causes account for about one third of failures to breast feed (ROBINSON, 1948 ; HYTTEN, 1954). In the Uganda children under review, if twins and orphan children are included, about half of the failures to breast feed are attributable to physical causes. It is to be expected that failure of lactation due to physical causes would be found in all parts of the world, regardless of the advent of modern civilization. In parts of the world with a very low standard of living, the problem would be less noticeable because most of the children concerned would die. The problem comes to light as the standard of living rises and more children survive who would otherwise have died. The high mortality among twin children is important, especially as twins occur more frequently in Uganda and in many tropical countries than in Europe (ROSS, 1952, RENDLE-SHORT, 1953). This has led to a superstitious attitude : in some parts of Africa twins are considered so unlucky that one or both of them are killed at birth. In Uganda twins are welcomed as extremely lucky. But even so, few mothers are able to feed them properly and the mortality is high.

MATTHEWS (1955), in a review of the ethnological and medical significance of breast feeding with special reference to Yoruba women in Nigeria, drew attention to the relative infrequency of breast disease among these people. In Western countries stress is often laid on ante-natal preparation of the breast and lowering the "milk tension" by complete emptying of the breast at regular intervals (WALLER, 1948). MATTHEWS points out that these factors are not important among many unsophisticated peoples. Although massage of the breast is sometimes performed by local " doctors," regular ante-natal preparation of the breasts is not practised — and, despite frequent and irregular suckling, the breast is probably rarely completely emptied of milk. It seems that under these conditions the breast functions satisfactorily without any special preparation or attention to detail. But as women become more sophisticated and self-conscious, difficulties arise which must be met by measures such as those suggested by WALLER.

Apart from physical causes, *failure of lactation*, underfeeding at the breast, was relatively uncommon in the present series of children. Little is known about the factors which determine the quantity and quality of lactation in human mothers. There is, of course, much inter-relation with personal psychological factors which make decisions far more difficult in humans than in farm animals. It is possible that, just as there are different strains of cattle with different capacities of lactation, some human mothers may be genetically better equipped for lactation than others. It has been shown that African women of another tribe living in Kampala (Luo women from Kenya) lactated far more abundantly and freely than Baganda women living in the same town (WELBOURN, 1955 a). It was suggested that, although there were dietary and cultural differences between the two groups of women, the difference may have been partly attributable to hereditary factors. The effect of the maternal diet on lactation does not appear to be as great as might have been expected. Farmers know that they must feed their cows abundantly in order to obtain high milk yields without detriment to their stock ; but this experience is not necessarily applicable to humans because dairy animals are expected to yield milk far in excess of that needed by their young. Experience in Africa has shown that most malnourished women, whose diet is often exceedingly deficient in protein, are capable of secreting milk of relatively normal composition for long periods without striking detriment to themselves (JELLIFFE, 1955). Indeed, lactation appears to be most satisfactory in areas where the standard of living is lowest.

One or two of the women in the present survey volunteered the information that, although their output of breast milk seemed abundant, the baby failed to grow fat. This led one to wonder whether the composition of their milk was normal, particularly as HYTTEN (1954) has shown that underfeeding may occur if the fat content of the milk is low. No analyses have been done of breast milk from women in Uganda. Surveys in West and South Africa (JELLIFFE, 1952 ; WALKER et al., 1952) have shown no abnormality in the protein or fat content of milk from African women in those areas.

A large proportion of the women in the present series started bottle feeding in the first place for personal reasons — supplementary bottle feeds being started although the baby showed no signs of underfeeding. Probably the most basic personal reason was loss of confidence. ROBINSON (1951) showed that in Liverpool many mothers started supplementary bottle feeding although their babies showed no sign of underfeeding. This was seen most often among mothers who, for some reason, lacked confidence in their ability to breast feed, either because of failure with previous children, or because the baby cried excessively at night. Under primitive conditions practically all mothers have complete confidence in their ability to breast feed because they know of no alternative. The women studied at our child welfare clinics knew of the possibility of bottle feeding and were thus more likely to lose confidence in the presence of difficulties—particularly if the baby cried a great deal. When questioned at the clinic, most mothers said that they started bottle feeding because they had no breast milk. Probably they were worried because the baby cried at night ; sometimes the husband bought a tin of dried milk in the hope of procuring peace at night. The importance of crying was difficult to assess. Although most of the babies seemed contended at the clinic, most mothers, whether fully breast feeding or otherwise, complained that their babies cried a great deal during the first few months of life. The crying often became less when the mother was advised about wind and other causes of discomfort which may make a baby cry.

JELLIFFE (1955) referred to the " snob appeal " which sometimes seems to be associated with the use of tinned milk products. The use of tinned baby foods and infant feeding bottles probably has a social prestige value along with other external trappings of modern civilization. This may be increased by the influence of commercial advertisements. In some parts of the world, local traders even employ nurses to visit homes encouraging the use of tinned milk products in place of breast feeding (WILLIAMS, 1956). Fortunately in Uganda there has been little commercial advertisements so far. But infant feeding bottles and imported infant foods are available even in many of the small up-country shops.

Although there may be a " snob appeal " associated with bottle feeding it is encouraging that this does not necessarily seem to be connected with a rising level of school education. The present investigation suggested that even a few years in primary school may help to promote breast feeding; possibly by inculcating a slightly more discriminating attitude. This is in accordance with the experience of BELL (1955) in Kenya who noted that supplementary bottle feeding was becoming fashionable among less educated women.

In South African towns (LONGMORE, 1954), babies are often bottle fed during the day-time because their mothers are out at work. Few Baganda women work outside their homes. The few uneducated women who work as domestic servants are usually able to keep their babies with them. More educated women who work as teachers or nurses usually breast feed for six to nine months and do not start work again until the baby is fully weaned. In the present investigation only one uneducated mother was found who started bottle feeding because she was out at work. Several women in the highly educated group had interests outside their homes which made it more convenient to have the baby weaned as soon as he was taking a full mixed diet.

Results of bottle feeding. The impression gained in the present survey was that many children who started by being well fed at the breast became underfed as a result of being offered supplementary bottle feeds of dilute milk mixture. Judging by their weight increase and general state of well-being most of the children seemed to be adequately breast fed at the time that supplementary feeding was started. But, after a few months of supplementary bottle feeding, most of the children showed signs of undernutrition. The reason for this was that the feeds were far too dilute. The most usual food used was boiled cows' milk, well diluted with water or occasionally tea. A few of the mothers used dried skim milk powder which was on sale at the clinic. About one third of them bought imported patent baby foods. Because they were expensive, these patent baby foods were thought to be very strong, so that one measureful was usually mixed with one cupful of water, and the instructions on the tin were never followed. One or two of the poorer mothers used maize porridge in the feeding bottle. One mother, who was told at the clinic that her two months old baby needed no milk except mother's milk, gave him soup in the bottle instead of milk. The bottle feeds were offered at frequent intervals in the day-time and tended to replace breast feeds. Breast feeding was usually abandoned within two or three months of starting supplementary feeding, although a few mothers managed to persevere until the child was a year old.

Even in modern civilized countries with a high standard of living, artificially fed babies are often found to be more prone to infections than those who are fully breast fed (ROBINSON, 1951). It is hardly surprising that the difference should be even more marked in less technically developed countries. After a month or two of supplementary bottle feeding, the children in the present survey were lighter for their ages and more prone to infections than their fully breast fed contemporaries. During 1955, three of the children studied developed kwashiorkor — of whom two were in the group who were supplementarily bottle fed. This is in accordance with observations on children with kwashiorkor in Kampala hospitals. Arificial feeding and premature weaning from the breast were common features in the histories of children admitted to Mulago Hospital with kwashiorkor during 1955 (DEAN, 1956). It would seem that supplementary feeding in early infancy often resulted in underfeeding which would not otherwise have occurred. This underfeeding lowered the child's reserves, and thus predisposed him to infections and possibly, later on in the weaning period, to kwashiorkor.

Apart from underfeeding and kwashiorkor, signs of specific nutritional deficiences were seldom seen. Iron deficiency anaemia was not seen. JELLIFFE (1955) referred to iron deficiency anaemia (suckling anaemia) as a universal problem in the tropics. MACKAY (1951) showed that it was also common some years ago in London, and that it occurred more commonly in children who were artificially fed. It has been shown that, apart from malaria, anaemia is not a problem among African children in Kampala. (WELBOURN, 1955). In the present series no difference could be shown between the haemoglobin levels of children who were bottle fed and children of the same ages who were breast fed. No signs of vitamin deficiences were seen in the children under review. The freedom of Baganda children from iron and vitamin deficiencies is partly attributable to the excellent climate in which they live; the rainfall is such as to ensure a constant supply of fresh foods, particularly green vegetables, which are used as relishes and fed to children together with plantains and sweet potatoes, from the time they are about six months old. Those of the children under review who were attending the clinic regularly were advised to start mixed feeding at five months (or earlier if the child showed signs of underfeeding) with bean soup, mashed banana and pawpaw, maize porridge and skim milk powder. Most of these children were therefore being offered diets which may have been low in protein and total calories, but were relatively mixed and rich in vitamins.

CONCLUSION

The tendency to resort to bottle feeding is generally associated with the advent of modern civilization. It is to be hoped that this will not bring disastrous consequences in Africa. Everything possible must be done before it is too late to emphasize the importance of breast feeding. It is encouraging that, in the present group, even a little school education seemed to have a favourable effect. It is important that this problem should be discussed in schools, and mothercraft teaching directed towards emphasizing the importance of breast feeding. Mothercraft teaching by all concerned, whether in schools, women's clubs, or clinics must avoid any possibility of giving an impression that bottle feeding has a social prestige value. Books on mothercraft for Western readers often give undue prominence to bottle feeding. Full use should be made of books written for readers in tropical countries in which breast feeding is accepted as the norm.

Much can be done by a friendly kind of ridicule. The strip cartoon in the vernacular newspaper and plays on the radio are already popular features in Uganda. In these, a story can be made of the trials of the family with a baby who screams at night. The mother can listen either to the wise suggestion of the nurse at the clinic or to the shopkeeper who suggests that she buys a feeding bottle and some expensive baby food. Much depends upon her choice.

SUMMARY

Until recently breast feeding was accepted by African mothers as the only means of rearing their babies. With the advent of modern civilization alternative methods of feeding became possible.

Among the Baganda living near Kampala, Uganda, it was found that there was a tendency, particularly among less well educated families, to resort to supplementary bottle feeding, usually with very diluted milk. The dilute supplementary feeds tended to replace breast feeds and thus resulted in underfeeding which would not otherwise have occurred. This underfeeding lowered the child's reserves, and predisposed him to infections and possibly, later in the weaning period, to kwashiorkor. The implications of this finding are discussed, and suggestions put forward for education and propaganda directed against the tendency to abandon breast feeding unneccessarily.

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EXCERPT

THE NATURAL HISTORY OF HOMOZYGOUS SICKLE-CELL ANAEMIA IN CENTRAL AFRICA

(TROWELL, H. C., RAPER, A. B. and WELBOURN, H. F. *Quart. J. Med.*, 1957, 26, 401)

An account is given of the course and clinical picture of 59 children suffering from sickle-cell anaemia seen in Uganda. All were proved to be homozygous for the sickling gene.

The series showed differences from the classical description of the disease, notably in the early onset, the rapid progress of the disease in early infancy, the frequency of characteristic bony swellings of the feet, the low survival rate, and the paucity of thrombotic incidents and leg ulcers.

THE DEATH-RATE IN THE AGE-GROUP 1-4 YEARS AS AN INDEX OF MALNUTRITION

by

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The death-rate of infants below the age of 1 is often used as a measure of the health of a country and the efficiency of its medical services. This is because the baby in its first year is exposed to particular stresses and hazards, and the most sensitive index is naturally one that relates to the period of greatest danger. The use of the infant mortality rate as an index of public health is based on experience in Europe and North America: it may not be so appropriate in less fortunate parts of the world. In this paper we suggest that the death-rate in the age-group 1 to 4 years may be in some ways more significant — a point to which LE GROS CLARK (1951), CICELY WILLIAMS (1955) and WELBOURN (1955) have also drawn attention.

In poor countries the effects of malnutrition are most severe in the young growing child. It has, however, been repeatedly pointed out that even in very malnourished communities the babies in general grow well for the first six months of life (F.A.O., 1955). This is because they are breast-fed, and the mother, even though she may be undernourished, seems to be able to provide enough milk during the early stages of lactation. At about 6 months growth begins to fall off (WATERLOW, 1948; WELBOURN, 1955), and by a year some babies are ill enough to need admission to hospital. In Jamaica the average age of cases admitted for kwashiorkor is about 1 year (JELLIFFE, BRAS and STUART, 1954). In Africa the peak incidence is between 1 and 2 years (TROWELL, DAVIES and DEAN, 1954). In Guatemala and Mexico it seems to be somewhat later: many cases are seen who are 3 years old or more.

These variations in the age of onset of kwashiorkor are probably related to two things— the duration of breast-feeding and the nature of the diet after weaning. In Africa breast-feeding is often continued for two years or more, though little is known about how much milk the baby actually gets during the later stages of lactation. In Central America the child after weaning is given a diet consisting mainly of maize and beans: this is less dramatically deficient in protein than the starchy paps that are the staple infant food in the West Indies, and perhaps for this reason the development of protein malnutrition is more insidious. In many parts of the world, therefore, kwashiorkor is a disease not of the infant but of the toddler.[†]

Kwashiorkor is the final stage: milder degrees of the same disease process are undoubtedly much more common. These cases of border-line undernutrition, called pre-kwashiorkor by DEAN, and first grade malnutrition by GOMEZ and his colleagues (1956), have been much less studied than frank kwashiorkor, because they are harder to detect

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[*] We are grateful to the Registrar General, Spanish Town, Jamaica, for permission to consult his records, from which Table III was compiled.

[†] For the sake of brevity, the word "infant" is used for the age-group 0-1 years, and the word "toddler" for the age-group 1 to 4 years

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and define. Nevertheless, there is every reason to suppose that what is true of kwashiorkor is true of the milder stages of malnutrition : that its main incidence is in the toddler. In an examination of 1,374 infants and preschool children in Jamaica, deficits in both weight and height were greatest between the ages of 1 and 2 years. (WILLS, 1957.)

TABLE I. Death rates below 1 year, and from 1-4 years, in various countries.

1	2	3	4	5	6
		Deaths per 1,000 live births			
Country	Date	A. 0-1 yr.	B. 1-4 yrs.	B./A. Ratio	Source
Trinidad	1935	99	29	.29	(1)
Trinidad	1954	60	12	.20	(1)
British Guiana	1954	73	28.5	.39	(2)
Jamaica	1951	81	35	.43	(3)
Rio de Janeiro, D.F.	1942	156	120	.77	(4)
United Kingdom	1870-72	150	99	.66	(5)
United Kingdom	1955	26	4	.155	(5)

Sources :

(1) Government of Trinidad and Tobago : Central Statistical Office. Population and Vital Statistics. Annual Report for the year 1954. Port-of-Spain. 1955.

(2) British Guiana : Annual Report of the Registrar General. Annual Summary for the year 1954. Georgetown. 1956.

(3) Jamaica : Annual Report of the Registrar General's Department for the year ended 31 December, 1951. Kingston. 1953.

(4) Ministerio de Educacão e Saùde : Departamento Nacional de Saude. Serviço Federal de Bio estatística. Anuário de Bioestatística. 1942-1946. Rio de Janeiro. 1951.

(5) Central Statistical Office : Annual Abstract of Statistics. No. 93. 1956. H.M.S.O., London. 1956.

TABLE II. Death rates below 1 year, and from 1-4 years, related to the corresponding rates in the United Kingdom 1955, taken as unity.

Country	Date	Relative death rate		Source
		0-1 yr.	1-4 yrs.	
Trinidad	1935	3.80	7.25	(1)
Trinidad	1954	2.31	3	(1)
British Guiana	1954	2.81	7.1	(2)
Jamaica	1951	3.12	8.75	(3)
Rio de Janeiro, D.F.	1942	6.0	30	(4)
United Kingdom	1870-72	5.75	25	(5)
United Kingdom	1955	1	1	(5)

Sources :

(1) Government of Trinidad and Tobago : Central Statistical Office. Population and Vital Statistics. Annual Report for the year 1954. Port-of-Spain. 1955.

(2) British Guiana : Annual Report of the Registrar General. Annual Summary for the year 1954. Georgetown. 1956.

(3) Jamaica : Annual Report of the Registrar General's Department for the year ended 31 December, 1951. Kingston. 1953.

(4) Ministerio de Educaçáo e Saùde : Departamento Nacional de Saùde. Serviço Federal de Bio-estatística. Anùario de Bioestatística. 1942-1946. Rio de Janeiro. 1951.

(5) Central Statistical Office : Annual Abstract of Statistics. No. 93. 1956. H.M.S.O., London. 1956.

It is very probable that the effect of malnutrition or undernutrition is reflected in the death-rates. It is true that in the statistical tables of causes of death the main killers in this age-group are gastro-intestinal and respiratory infections. However, most pediatricians would probably agree that malnutrition vastly reduces the child's resistance to these diseases. Malaria probably comes in the same category. For example, in the Gambia almost 100 per cent. of infants were found to be infected after the first few months of life (McGregor and Smith, 1952). It was our experience when working there that the undernourished very easily succumbed. The combined effect of these two stresses — malaria and malnutrition — results in a mortality during the first four years of life that may well be in the region of 500 per 1,000 live births (Jelliffe, 1952).

In practice it is extremely difficult, if not impossible, to disentangle the effects of malnutrition and of infection, even at autopsy (Bras, Waterlow and DePass, 1956). Infection presumably gives the *coup-de-grâce*, and is therefore naturally diagnosed as the primary cause of death. Moreover, the nature of the statistical classification that is used in official tables tends to obscure the part played by malnutrition. Of the ones consulted for this article, only that of British Guiana at present lists kwashiorkor as a cause of death. The official classification includes the category " avitaminosis and other deficiency states," but this tends to concentrate attention on specific signs of malnutrition, which are usually absent.

For these reasons we suggest that the crude death-rates between 1 to 4 years may be used, as a first approximation, as an index of malnutrition, even though malnutrition as such may hardly figure in the listed causes of death.

Some examples of death-rates in different countries between 0 to 1 years and 1 to 4 years are shown in Table I. The important point, made more clear in Table II, is that

TABLE III.

Parish	% of all deaths registered		
	A. 1/12-1/year	B. 1-4 yrs.	B./A.
Kingston	11	5.3	.48
St. Andrew	12.1	7.1	.59
St. Thomas	13	5.5	.42
Portland	14.2	8.2	.58
St. Ann	12.1	11.3	.93
St. Mary	13.6	5.9	.44
St. Catherine	14	9.1	.65
Clarendon	13.8	12.2	.88
Manchester	13.2	8.5	.64
St. Elizabeth	16.2	11.9	.73
Westmoreland	18.4	14.2	.77
St. James	18.5	12.0	.65
Hanover	19.3	13.9	.72
Trelawny	16.9	11.9	.70

Footnote.

The figures in the last column (ratio (B/A) are not directly comparable to those of Table I. In Table I the figures in column 3 refer to the total mortality under 1 year, including neonatal deaths. In Table III, neonatal deaths have been excluded. According to the Jamaica statistics for 1951, neonatal deaths accounted for 38 per cent. of the total deaths under 1 year. For comparison with Table I, the ratios in Table III should therefore be reduced in this proportion. This would give a mean ratio for the whole island of 44, with a range of 30-65.

the infant mortality rates vary far less than the death-rates between 1 and 4 years. It is striking, for instance, that in the U.K. since 1870 the infant mortality rate has been reduced by a factor of 6, but the mortality between 1 and 4 years has been reduced 25 times. Very roughly, the toddler death-rate in the various countries corresponds with the impression of the nutritional state of the region gained from personal survey and from the literature (WATERLOW, 1948 ; WATERLOW and VERGARA, 1956).

Some figures for individual parishes of Jamaica are shown in Table III. The proportion of deaths in the 1 to 4 age-group is higher in the western end of the island, and this again agrees with clinical impressions of the nutritional state. There are two advantages in expressing these figures as a ratio : deaths 1-4 years/deaths 1 month-1 year. In the first place, it helps to even out the effects of bad hygiene, and consequent gastro-intestinal and respiratory infection, since these influences will presumably bear equally on both age-groups. Secondly, it is notorious that birth registrations tend to be incomplete, death registrations more complete. Thus infant mortality rates tend to be inflated. But it is reasonable to suppose that errors in *death* registration will be comparable in the two age-groups, and again will be evened out if the results are expressed as a ratio.

In going through these records, an attempt was made to separate off cases in which malnutrition was at least a contributory cause of death. Under this heading we have included cases with the following diagnoses in the death register : malnutrition ; marasmus ; kwashiorkor ; nutritional oedema ; " puny from birth." We have also included cases diagnosed as nephritis or nephrosis, because we do not believe that these diseases really have a significant incidence in this age-group. It seems likely that the majority are cases of oedema due to kwashiorkor. We also supposed that vomiting, worms and teething are unlikely by themselves to cause death, and are possibly symptomatic of malnutrition. Many of the diagnoses must remain a matter of supposition, and the classification is inevitably very rough. Taking the average of all the parishes, the result was as follows :

between 1/12 and 1 year : 32.5 per cent. of deaths were attributable to malnutrition.
between 1 and 4 years : 46 per cent. of deaths were attributable to malnutrition.

SUMMARY

The infant mortality rate is widely used as an index of the state of public health. Such an index is valuable because it is based on a period of life when the danger of death is relatively high. However, the period of greatest danger is not necessarily the same in all countries and all environments It is suggested that malnutrition tends to raise morbidity and mortality predominantly in the age-group 1 to 4 years The mortality rate in this age-group might therefore be useful as an index of the nutritional status of a country.

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SCHOOL FEEDING:
SOME PRESENT-DAY CONCEPTS AND ACTIVITIES

by

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In recent years, particularly within the last ten to fifteen years, interest in school feeding on the part of governments has grown extensively. Why has this been so? It may be recalled that school feeding has had an interesting historical development. A number of early attempts in this direction are recorded in the eighteenth and nineteenth centuries. They were generally undertaken in order to bring some measure of relief to specially needy children, and were usually promoted by voluntary organizations and welfare agencies. During the second decade of the present century, school feeding began to be influenced by a new and important factor, the development of the modern science of nutrition. Gradually it became clear that children need not only enough food, but also enough of the right kinds of food. Their requirements for protein and certain other nutrients are relatively greater than those of adults and they readily suffer ill effects when their diet is deficient. Children will not grow into healthy adults if they are malnourished during the active period of growth and physical development. Malnutrition may affect not only their health, but also their capacity to learn.

School feeding has thus come to be looked upon as an important means of improving child nutrition — not only because it can provide the child with nutritionally valuable foods, but also because it can help to interest him in the " why's and therefores " of sound eating habits. The school child is at a formative stage and a school feeding programme can help him to grow and also influence his ideas and attitudes towards food. The present-day interest in school feeding may be regarded as a reflection of our growing knowledge and appreciation of the importance of good nutrition to child health and welfare.

To be effective as a nutritional measure, a school feeding programme must be carefully planned and executed. Information on food consumption, nutritional status, food traditions and customs, as well as economic conditions, is of the utmost importance as a basis for planning a satisfactory feeding programme, as well as the nutrition education activities which should be associated with it. In many countries now embarking on school feeding, information of this nature is not readily available. For example, in only a few countries have dietary surveys been carried out systematically among representative groups of the population. Where dietary data are lacking or insufficient, a general idea of the food situation within a country can be gained from the so-called Food Balance Sheets, now prepared annually by most countries, which show, on a *per caput* basis, the estimated available supplies of food. The Food Balance Sheets give only statistical averages for the population as a whole, and provide little indication of the food supplies available to the different economic, geographical or age groups within the population.

the infant mortality rates vary far less than the death-rates between 1 and 4 years. It is striking, for instance, that in the U.K. since 1870 the infant mortality rate has been reduced by a factor of 6, but the mortality between 1 and 4 years has been reduced 25 times. Very roughly, the toddler death-rate in the various countries corresponds with the impression of the nutritional state of the region gained from personal survey and from the literature (WATERLOW, 1948 ; WATERLOW and VERGARA, 1956).

Some figures for individual parishes of Jamaica are shown in Table III. The proportion of deaths in the 1 to 4 age-group is higher in the western end of the island, and this again agrees with clinical impressions of the nutritional state. There are two advantages in expressing these figures as a ratio : deaths 1-4 years/deaths 1 month-1 year. In the first place, it helps to even out the effects of bad hygiene, and consequent gastro-intestinal and respiratory infection, since these influences will presumably bear equally on both age-groups. Secondly, it is notorious that birth registrations tend to be incomplete, death registrations more complete. Thus infant mortality rates tend to be inflated. But it is reasonable to suppose that errors in *death* registration will be comparable in the two age-groups, and again will be evened out if the results are expressed as a ratio.

In going through these records, an attempt was made to separate off cases in which malnutrition was at least a contributory cause of death. Under this heading we have included cases with the following diagnoses in the death register : malnutrition ; marasmus ; kwashiorkor ; nutritional oedema ; " puny from birth." We have also included cases diagnosed as nephritis or nephrosis, because we do not believe that these diseases really have a significant incidence in this age-group. It seems likely that the majority are cases of oedema due to kwashiorkor. We also supposed that vomiting, worms and teething are unlikely by themselves to cause death, and are possibly symptomatic of malnutrition. Many of the diagnoses must remain a matter of supposition, and the classification is inevitably very rough. Taking the average of all the parishes, the result was as follows :

between 1/12 and 1 year : 32.5 per cent. of deaths were attributable to malnutrition.
between 1 and 4 years : 46 per cent. of deaths were attributable to malnutrition.

SUMMARY

The infant mortality rate is widely used as an index of the state of public health. Such an index is valuable because it is based on a period of life when the danger of death is relatively high. However, the period of greatest danger is not necessarily the same in all countries and all environments. It is suggested that malnutrition tends to raise morbidity and mortality predominantly in the age-group 1 to 4 years. The mortality rate in this age-group might therefore be useful as an index of the nutritional status of a country.

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SCHOOL FEEDING :
SOME PRESENT-DAY CONCEPTS AND ACTIVITIES

by

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In recent years, particularly within the last ten to fifteen years, interest in school feeding on the part of governments has grown extensively. Why has this been so ? It may be recalled that school feeding has had an interesting historical development. A number of early attempts in this direction are recorded in the eighteenth and nineteenth centuries. They were generally undertaken in order to bring some measure of relief to specially needy children, and were usually promoted by voluntary organizations and welfare agencies. During the second decade of the present century, school feeding began to be influenced by a new and important factor, the development of the modern science of nutrition. Gradually it became clear that children need not only enough food, but also enough of the right kinds of food. Their requirements for protein and certain other nutrients are relatively greater than those of adults and they readily suffer ill effects when their diet is deficient. Children will not grow into healthy adults if they are malnourished during the active period of growth and physical development. Malnutrition may affect not only their health, but also their capacity to learn.

School feeding has thus come to be looked upon as an important means of improving child nutrition — not only because it can provide the child with nutritionally valuable foods, but also because it can help to interest him in the " why's and therefores " of sound eating habits. The school child is at a formative stage and a school feeding programme can help him to grow and also influence his ideas and attitudes towards food. The present-day interest in school feeding may be regarded as a reflection of our growing knowledge and appreciation of the importance of good nutrition to child health and welfare.

To be effective as a nutritional measure, a school feeding programme must be carefully planned and executed. Information on food consumption, nutritional status, food traditions and customs, as well as economic conditions, is of the utmost importance as a basis for planning a satisfactory feeding programme, as well as the nutrition education activities which should be associated with it. In many countries now embarking on school feeding, information of this nature is not readily available. For example, in only a few countries have dietary surveys been carried out systematically among representative groups of the population. Where dietary data are lacking or insufficient, a general idea of the food situation within a country can be gained from the so-called Food Balance Sheets, now prepared annually by most countries, which show, on a *per caput* basis, the estimated available supplies of food. The Food Balance Sheets give only statistical averages for the population as a whole, and provide little indication of the food supplies available to the different economic, geographical or age groups within the population.

However, data of this nature can frequently be supplemented by knowledge of dietary habits possessed by local workers. Here the social anthropologist can sometimes make a useful contribution, particularly in areas in which little is known about dietary patterns and the kinds of local foods which are habitually eaten. Such information is needed because a school feeding programme should, as far as possible, provide the nutrients which are generally lacking in the home diet of the child.

Because of the differences in food supplies, food habits, economic conditions, etc., there can be no uniform method of school feeding appropriate to all countries, or even perhaps to all districts within a country. In general, school feeding programmes may be divided into two types : those which provide a complete meal, usually served at midday ; and those which take the form of a nutritious snack served at an appropriate time in the course of the school day. Economic conditions usually determine which type can most feasibly be undertaken : they also influence the nutritional targets that can be aimed at. A complete meal may be one, two or three courses, depending upon meal customs in the country concerned. An example of a one-course meal may be found in the meal pattern recommended by the First Regional Nutritional Committee for South and East Asia, convened by FAO in the Philippines in 1948. This pattern includes specified amounts of cereals, such as lightly milled rice, high extraction wheat or millets ; a pulse ; small fish of which the body can be eaten to provide calcium ; vegetables, with preference given to green leafy vegetables ; and oil, preferably an oil containing carotene. A meal of this kind will provide about 400 calories and will contain all the essential nutrients. It may of course be modified in various ways in accordance with local conditions and the availability of various foods. For example, fruits rich in pro-vitamin A might be supplied as an alternative to the vegetables. Meals of this type are now being provided in a number of countries in the region.

Where preference is given to a snack, rather than a meal, milk is generally used. This may be served together with some other cheap and easy-to-provide food such as bread, biscuits, or the local equivalent. The provision by UNICEF of dried skim milk for child feeding programmes has enabled many governments to institute school milk distribution schemes. Dried skim milk, now a surplus commodity in several countries, is also being made available to governments through other channels for welfare purposes.

There was a time when there was a tendency for dried skim milk to be frowned upon as an inferior food, particularly by those planning welfare activities, but experience has proved that children *will* drink dried skim milk, if it is properly reconstituted. It is no longer considered necessary to " doctor it up " with sugar and flavourings, the cost of which may be high for the government concerned, and thus detract from expenditure on other items. Most children do in fact like rather bland foods. It is also being realized that dried skim milk can be used in many ways aside from a beverage.

One point may perhaps be emphasized ; the way in which foods are prepared and eaten in the school must not be so dissimilar from the way in which they can be prepared and eaten in the home that the child sees little connection between school and home meals. He will, in that case, learn no practical lesson ; the home will remain the home and the school the school, two distinct and unrelated worlds. Great ingenuity is very often needed to find the foods, or food combinations, that will meet the nutritional objectives of the school feeding programme, appeal to the children and at the same time be within the ever-present limits posed by financial considerations and problems of supply.

School feeding implies a division of responsibility between the home and the school for the nutritional welfare of children. Parents, knowing their children receive food at school, may tend to neglect the child's diet at home. They need to be fully informed of the rôle of the school meal and encouraged to see that the school meal and the home meals together provide a nutritionally satisfactory diet for the child. School feeding can in fact, be the springboard for community nutrition work.

School feeding programmes are important not only in the many countries in which food production and consumption remain far below desirable levels, but also in countries with an abundance of food but where wise eating habits are not always practised. In such cases, the educational value of the programme may be more important for the child than the food he receives. Experience has shown that school feeding programmes can be undertaken effectively in both food surplus and food deficit countries. In the latter they help to ensure that the best use is made of available supplies. They may also create a demand for certain kinds of food in which the national diet is generally deficient, and which can be met only by appropriate planning and extension of production. This may be done on the local level through the promotion, for example, of school and community gardens to provide vitamin-rich vegetables or on a country-wide basis, such as by the development of the dairy industry.

It will be evident that school feeding is of concern to educational, health, nutrition and agricultural authorities as well as to parents, and a satisfactory programme represents a coordinated effort on the part of all these. In fact, coordination seems to be the keynote of any really good programme.

At the international level, considerable attention has been focussed on school feeding. A primary objective of FAO is to raise levels of nutrition and, in the broad programme of the organization directed towards this aim, particular attention is devoted to population groups having special nutritional needs — mothers, infants and children. Various FAO Conferences and Regional Nutrition Meetings have emphasized the importance of school feeding in improving nutrition conditions among this age-group. The collection, appraisal and distribution of information on school feeding programmes is one service performed by FAO with the hope that it will stimulate interest and action in developing appropriate programmes.

Much of FAO's field work connected with school feeding is done in cooperation with UNICEF. For example, FAO has provided nutrition experts to a number of countries receiving UNICEF dried milk supplies. These experts help to get the feeding schemes established on sound lines according to the needs and resources of the country, to develop nutrition education activities and train local workers to carry on. FAO and WHO have carried out surveys of food and nutrition conditions with special reference to children in a number of countries, the results of which have led to the initiation of school feeding programmes for which UNICEF provides supplies and FAO a nutrition expert. In 1953, FAO organized, with UNICEF and WHO, a School Feeding Seminar for countries in Central America, including Panama. Each of these countries had been receiving UNICEF aid, for its school feeding programme. The Seminar was attended by workers in charge of school feeding in the different countries. Practical problems were discussed and attention was given to the use of local foods and to education in nutrition, the object of the Seminar being to encourage the continuation of school feeding on a satisfactory basis with local resources. Requests have recently been made for similar seminars elsewhere.

Of less direct bearing, but of no less importance, is the attention given by FAO to the training of nutrition personnel through its Fellowship programme, as well as regional training centres, which are often arranged in cooperation with WHO. The satisfactory development of school feeding and related educational activities is in large measure dependent upon the guidance of nutrition workers, of which there is a great lack in many countries.

Reference has already been made to dried milk surpluses. Although this commodity has been, and can be, of great value in promoting school feeding programmes in the less developed countries, it is only a temporary expedient unless simultaneous efforts are made by the receiving countries to provide for the continuation of such schemes when free surpluses are no longer available. These efforts may be directed towards developing the local dairy industry where such is feasible, or to promoting the production of other nutritionally important foods — or food products. Support of such activities figures prominently in FAO's activities.

While the pre-school child usually presents more formidable problems from the nutritional standpoint than does the school-age child, malnutrition is nevertheless often serious in the latter. School feeding provides a concrete means of improving the nutrition of this age group, as well as acting as an important starting-point for wider programmes of nutritional improvement. Well-organized school feeding schemes can undoubtedly make a valuable contribution in the general sphere of " tropical pediatrics."

EXCERPTS

KULTURKONTAKT UND KULTURZERFALL

(BUHLER, A. *Acta Tropica*, 1957, **14**, 1)

Although not strictly pediatric, this paper is mentioned as being an excellent recent account of the effect of cultural contact and cultural " decay," with all its implications as far as child rearing in a community no longer sure of its customs and behaviour.

The article concerns recent changes in the unsophisticated people of the Sepik District in New Guinea. It is strikingly illustrated.

SERUM ELECTROLYTES AND PROTEINS IN KWASHIORKOR

(POLITZER, W. M. and WAYBURNE, S. *Brit. J. Nutr*, 1957, **II**, 105)

Serum electrolytes were investigated in sixty-three African patients in Baragwanath Hospital, Johannesburg who were suffering from kwashiorkor. No correlation was found between the degree of oedema, and serum sodium or potassium levels , and no correlation was noted between the severity of diarrhoea and the serum sodium levels. The serum potassium level was reduced in subjects suffering from diarrhoea and severe hypokalaemia was present in four of the eleven fatal cases. There was only limited correlation between the changes in total serum protein and albumin and subsidence of oedema

COPPER IN HEALTH AND DISEASE

(WINTROBE, M. M. *Amer. J. Clin. Nutr*, 1958, **6**, 75)

In this review attention is drawn to present lack of knowledge of the part played by copper in human nutrition. Views concerning animal disease associated with hypocupraemia are summarised, as are the recent concepts of the part played by this metal in Wilson's disease.

It is noted that, although hypocupraemia has not as yet been observed in human nutritional disease, a new syndrome has recently been described in infants in which low plasma levels of iron, copper and protein are associated with oedema and hypochromic anaemia.

A FIELD STUDY OF INFANTILE DIARRHOEA IN ISRAEL

by

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The morbidity from infantile diarrhoea in Israel is still considerable. So far no accurate morbidity figures have been available, but the infant mortality caused by gastro-enteritis has been one clear indication of the importance of this problem. In 1954 there were 198 cases of death from gastro-enteritis in infants, giving a rate of 4.82 per 1,000 live births. The total number of infant deaths in the same year was 1,417 giving a rate of 34.52. Another indication is the high hospitalization rate for this condition ; children's wards in this country are filled to capacity each summer by cases of infantile diarrhoea and toxicosis. At the beginning of the summer of 1954 the Ministry of Health decided on an intensified programme of public health nursing in and around Well-Baby Clinics in new immigrant camps and villages in which the hospitalization rate for infantile diarrhoea was particularly high. This programme aimed at reducing the number of cases requiring hospitalization. It was decided to conduct, within the framework of this programme, an epidemiological investigation into the morbidity of this disease. The investigation was undertaken for the following purposes :

(1) to collect accurate data on morbidity ;
(2) to collect quantitative data on factors in the infants, in the home, and in the environment commonly believed to be associated with diarrhoea, and to establish possible correlations between these factors and the frequency of diarrhoea.

The present publication comprises the results of observations over four summer months, representing a pilot study in preparation for a full year's epidemiological investigation.

The field trial was conducted in the administrative district covering the central part of the coastal plain (District Health Office, Ramle). Localities chosen for the trial were three *maabaroth*† and two immigrant smallholder settlements. It is believed that general conditions as well as diarrhoea morbidity in these localities are representative of similar places all over the country. Only children up to 3 years of age were included in the study.

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* We wish to acknowledge our indebtedness to the District Health Officer, Dr. B. Brachot, who played an integral part both in the planning and in the daily supervision of the survey, and to his devoted team of Public Health nurses.

† A *maabara* is a provisional, camp-like immigrants' settlement.

DESCRIPTION OF LOCALITIES

(1) *Ramle B.* This is a *maabara* composed of wooden huts, each of which consists of one room (3 x 6.2 metres) with a sink in one corner, which represents the only " kitchen facilities " provided. A water-tap is situated outside and serves two huts (two families). Earth-latrines and showers are also in out-houses, each serving two families. The total population of this *maabara* is approximately 4,000 (all of whom immigrated after 1948), deriving mainly from Iraq and Morocco. Smaller groups are from Egypt, Tunis, Libya and Persia, with single families from Roumania, Turkey and Bulgaria.

(2) *Ramle C.* This *maabara* is situated approximately 500 metres from Ramle B. The total population of approximately 1,800 has a similar composition to that of Ramle B and housing conditions are essentially the same. The two *maabaroth* are situated at a distance of 1 km. from the town of Ramle, which lies in the central coastal plain approximately 30 km. inland from the coast.

(3) *Maabara Kakun.* This small *maabara* also consists of wooden huts, with one to one-and-a-half rooms per family. Earth-latrines and showers in outhouses each serve two huts. The total population is 310, mostly from the Yemen, with a few families from Iraq, Tunis and other countries. The *maabara* is situated in the northern half of the coastal plain near the Jordan border.

TABLE I. Children included in diarrhoea survey in the five localities according to age-groups.

Locality	0-1	1-2	2-3	Exact Age Unknown	Total
Ramle B	131	131	103	3	368
Ramle C	71	58	39	1	169
Kakun	4	8	5	—	17
Maapil North	17	15	9	—	41
Hadid	16	14	24	—	54
Total	239	226	180	4	649

(4) *Maapil North.* This is a smallholder settlement close to Maabara Kakun. Families live in small concrete houses with 1½ to 2½ rooms, according to size of family (the larger houses being for families with more than 4 children). Earth-latrines and showers are outside, one for two families. The total population is approximately 600 and consists of immigrants from Iraq and Persia only.

(5) *Hadid.* This is a smallholder settlement consisting of small concrete houses with 1 to 2 rooms according to size of family. There are kitchen-sinks, taps and showers inside the house ; earth-latrines are outside, one for each family. The total population is 350. All settlers are from the Yemen, apart from one single family which came from Iraq. The number of children in the survey is 54. Hadid is situated in the central coastal plain, at a distance of 4 km. from the town of Lydda.

A synoptic table is given below, showing the children in the five localities, divided into the age groups 0-1, 1-2, and 2-3 years (Table I).

SURVEY METHODS

The survey was carried out over a period of four months, August to November, 1954. For every child in the survey a questionnaire was filled out. At the end of the observation period the data on the questionnaire were transferred to Marginal Punched Cards and analyzed. The following data were recorded on the questionnaires :

(i) Demographic data : date of birth, place of birth, country of origin, date of immigration of family, occupation of father, number of persons in household, number of rooms ;
(ii) Diarrhoea register : date of onset and duration of each spell of diarrhoea, character of diarrhoea (dehydration etc.), hospitalization with dates ;
(iii) Type of milk used for feeding : breast feeding, fresh cow's milk, milk-powder and the various combinations of these : the type of milk was recorded at the beginning of the survey period and again whenever a spell of diarrhoea occurred ;
(iv) Weights : birth-weight, weight at the beginning and end of the survey period and the last weight recorded before each spell of diarrhoea ;
(v) Sanitary conditions and hygiene habits (recorded at the beginning and end of the survey period) ;
  (a) general cleanliness of household ;
  (b) hygiene in handling the baby's food-utensils ;
(vi) Presence of ice-box and regularity of ice-supply.

The nurse (or nurses) saw the children at regular intervals at the Well-Baby Clinic and on home-visits. Each child's home was visited at least once a week in order to detect unreported cases of diarrhoea. During spells of diarrhoea the child was visited every day, until two days had elapsed since the cessation of the diarrhoea.

The nurses' duties (apart from recording the data for the survey) were the usual tasks performed in and around Well-Baby Clinics — weighing, advice on feeding, hygiene education at home etc. In addition to this, special instructions were given for dieting in cases of diarrhoea.

Definition of Terms. For the measurement of morbidity in this study we have used the definitions recommended in the publication of the General Register Office, London (1954) and adapted them for our purposes as follows :

Spells of Diarrhoea — a spell of diarrhoea was recorded when the child had, in the opinion of the nurse, an increased number of loose stools on one or more consecutive days. In practice almost no spells under two days' duration were recorded, and we feel reasonably sure that no instance of a few loose bowel movements, of no clinical significance, were recorded as spells of diarrhoea. A new spell was recorded when at least three normal days had elapsed since the last day of a previous spell of diarrhoea.

Inception Rate (Spells) — the number of spells of diarrhoea which started during the four months period divided by the number of children observed during that period.

Inception Rate (Children) — the *proportion* of children who started at least one spell of diarrhoea during the four months period. That is the number of such children divided by the total number of children under observation.

Average Number of Spells per Sick Child — the number of spells of diarrhoea during the four months period divided by number of children who experienced at least one spell during the same period.

Duration (of diarrhoea) — the number of days in each spell of diarrhoea.

Total duration — the sum of durations of all spells in all the children of the survey, or of a defined group of these children, over the four months period.

Average Duration per Spell — the total duration (as defined above) divided by the number of spells during the same period.

Average Duration (of diarrhoea) per Child — the total duration divided by the number of children under observation.

Average Duration per Sick Child — the total duration divided by the number of children who experienced at least one spell during the four months period.

RESULTS

Morbidity by Age. Table II gives the number and rates of diarrhoea spells and durations for all the children in the survey as well as for the separate age groups (0 to 5 months, 6 to 11 months, 1 to 2 years, and 2 to 3 years).

The outstanding features may be summarized as follows — children under the age of three years had — during four summer months, i.e., 122 days — an inception rate (corresponding to the more generally used term incidence) *of 1.62 spells of diarrhoea* per child, with an average number of 11.24 days of diarrhoea (average duration per child). Nearly 70 per cent. of all children experienced at least one spell of diarrhoea. The morbidity in children between 6-11 months and 12-23 months is considerably higher even than this average (*inception rates* 2.38 *and* 2.08 ; *average duration per child* 16.92 *and* 13.66 days).

These figures give a good indication of the magnitude of the general problem of diarrhoea in infants in this sector of the Israel population. Accurate quantitative information on diarrhoea morbidity in infants has so far not been available in Israel, nor — to the author's knowledge — in the international literature.

As to the difference in morbidity rates in the various age groups, which are statistically highly significant, we suggest that the lower morbidity in infants under 6 months is due to less contact with noxious influences in the environment in general and in the food in particular (especially because of breast feeding, which is also considered in the section on types of milk) ; while children above the age of two years seem to have built up a certain degree of resistance.

We have also given the figures for the average number of spells and duration of diarrhoea per sick child (Table III). These figures give a clearer picture of the problem from a clinical point of view, as the clinician is interested to know how many days a child suffers on the average from diarrhoea, if it does not escape the disease altogether.

Table IV shows the frequency distribution of children arranged by five-day units of

TABLE II. Number of spells and duration of diarrhoea during survey period in different age groups.

Age	Number of children	Number of spells	Inception rate (spells)	Total duration (days)	Average duration per *child* (days)	Average duration per *spell* (days)
All Ages	649	1,053	1.62	7,295	11.24	6.93
0-5 months	130	123	0.95	777	5.98	6.32
6-11 months	109	259	2.38	1,844	16.92	7.12
1-2 years	226	471	2.08	3,082	13.64	6.54
2-3 years	180	189	1.05	1,519	8.44	8.04
Exact age unknown	4	11	—	73	—	—

TABLE III. Inception rate, average number of spells and their duration in *different age groups*—sick children.

Age	Number of children	Number of *children* with spells	Inception rate (*children*) %	Average number of spells per sick *child*	Average duration per sick child (*days*)
All ages	649	441	67.9	2.39	16.54
0-5 months	130	69	53.1	1.78	11.26
6-11 months	109	96	88.1	2.70	19.21
1-2 years	226	176	77.9	2.68	17.51
2-3 years	180	97	53.9	1.95	15.66
Exact age unknown	4	3	—	—	—

total duration of diarrhoea per child. The table shows a steady decrease in the number of children from the low units to the higher units.

In order to simplify the calculation of average duration we have used the arithmetic mean of each five-day unit (e.g., 3 as the mean for unit 1-5 days) to calculate the duration in each unit, obtaining total duration by summing these calculated durations for all units.

Table V gives a comparison between the true averages and the averages calculated by the above method for each age-group and for the total of the children in the survey. It will be seen that the differences are very small. In the analysis of the diarrhoea morbidity in children in relation to various factors, we have used the average durations per child as the most reliable and most simply understood measurement. In all cases we have calculated average duration by the method described above.

Diarrhoea Morbidity by Sex. The average duration of diarrhoea was higher in girls than in boys, 11.86 and 10.94 days. This difference is not statistically significant. It is worth noting that a similar sex difference is found in mortality from gastro-enteritis in infants and small children. We cannot at present offer a convincing explanation for this phenomenon.

TABLE IV. Frequency distribution of children by total duration of diarrhoea spells.

Total duration of diarrhoea (days)	All ages (0-3 years)	
	Number of children	Percentage of total
All durations	649	100
0	208	32.0
1-5	104	16.0
6-10	82	12.7
11-15	84	13.0
16-20	45	6.9
21-25	35	5.4
26-30	19	2.9
31-35	20	3.1
36-40	19	2.9
41-45	9	1.4
46-50	7	1.1
51-55	8	1.2
56-105	9*	1.4

* 1 child, 56-60 days ; 4 children, 61-65 days ; 2 children, 66-70 days : 1 child, 76-80 days : 1 child, 101-105 days.

TABLE V. Comparison between actual average duration and estimated average duration (see Text).

Age groups	Number of children	Actual average duration per child (days)	Estimated average duration per child (days)	*Difference* between the two averages
Total (all ages)	649	11.24	11.36	+0.12
0-5 months	130	5.97	6.05	+0.08
6-11 months	109	16.92	17.27	+0.35
1-2 years	226	13.64	13.75	+0.11
2-3 years	180	8.44	8.45	+0.01
Exact age unknown	4	—	—	—

Diarrhoea Morbidity in Relation to Various Environmental and Host Factors. The analysis of average diarrhoea duration according to various factors has, in the preliminary study, brought out some interesting facts. On the other hand, observations during the survey and the scrutiny of the data recorded revealed a number of deficiencies in our recording technique as well as the influence of additional factors which, not having been included in the questionnaire, were not recorded quantitatively. The lessons learnt from the preliminary survey have been used in the planning of the full year's study at present under way. It was, therefore, decided not to publish the full results of the factor-analysis in this preliminary report, but to comment briefly on some of the outstanding features.

(i) *Country of origin.* Diarrhoea morbidity was higher among children of immigrants from Iraq than among these from Egypt and Morocco. The difference is statistically significant. It is not suggested that the differences are due to differences in " racial " susceptibility, but rather to divergent habits acquired in various countries.

(ii) *Socio-Economic Status.* Children in the survey were classified into four socio-economic classes according to the occupation of the father. Diarrhoea morbidity, as expressed by average duration, rose with descending socio-economic class as follows :

Class I	Fully employed skilled workers	6.65 days.
Class II	Fully employed unskilled workers	10.19 days.
Class III	Partly employed workers	11.47 days.
Class IV	Unemployed	13.11 days.

The differences are statistically significant ($P = 0.045$)*. It should be mentioned that social classification in some parts of our population was unsatisfactory, so that a more detailed analysis — most desirable for this important subject — was impossible with the data collected in the pilot study.

(iii) *Degree of Crowding.* No correlation was found between diarrhoea morbidity and degree of crowding. Average duration by number of persons per room fluctuated irregularly, with insignificant differences, through the degrees of crowding.

(iv) *Type of Milk.* The question of milk supply for this mainly poor population presents a considerable problem, primarily on account of the relatively high price of fresh milk and difficulties in its distribution in semi-rural areas. In order to ensure a good supply of milk to babies, a reasonable amount of dried milk powder — mostly of the full-cream variety — is made available to this population at a low price subsidized by the Government. Some pediatricians in the country were also of the opinion that fresh milk itself might be a source of diarrhoea, and they saw therefore an additional advantage in the supply of dried milk powder. Sanitary conditions in the supply of fresh milk are not satisfactory in many parts of Israel, especially in some of the villages included in our survey, because of the contamination of the milk and the multiplication of bacteria that occurs in the long hours of transport in non-sterile containers, even if the milk was originally pasteurized.

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* The significance of differences in diarrhoea morbidity between groups of children (grouped by age, country of origin, economic status or any other factor) was tested on the frequency distributions of the children in these groups according to the number of diarrhoea days experienced. Significance could not be tested on the average durations, as the frequency distributions were far from normal (Table IV).

The X^2 test was used. The value of X^2 increases with departure from the expected distribution — whether positive or negative — not only when the departures augment, but also when they diminish the difference in the average duration. It follows that in our case this X^2 test can be used only, if the latter kind of departure is not present. Thus the group with the lower average duration has to have higher frequency than expected in the shorter duration cells, and lower frequency in the longer duration cells. Whenever a reversion of this order occurs, no weight can be attached to a significant value of X^2. It should be noted that in effect no such reversion occurred in any one of our computations which yielded a significant value of X^2.

Table VI shows some of the results of the analysis of morbidity age and type of milk. In infants under 6 months, the much lower diarrhoea morbidity in those breast-fed than in babies given additional milk powder or milk powder alone is clearly seen (statistical significance of difference : P = 0.005). In the age group 1-2 years, children fed with fresh milk have a considerably lower average duration than those fed with milk powder or milk powder plus breast-milk ; the difference is statistically highly significant (P = 0.0005). The lower morbidity in babies fed with fresh milk was not associated with better socio-economic status.

TABLE VI. Average duration (days diarrhoea) in different age groups.

Age	Breast milk	Breast milk plus milk powder	Milk powder	Fresh milk	Total for age group
0-5 months	4.22 (83)*	9.21 (32)	8.76 (13)	—	6.13
1-2 years	—	17.07 (40)	14.38 (130)	8.3 (54)	13.75

* Number of children in each group in brackets.

This rather surprising finding seems to indicate that fresh milk itself does not cause an outstandingly high diarrhoea morbidity. The high morbidity figure for children fed with dried milk powder cannot, however, be accepted without qualifications and reservations. It appeared that in many instances the supply of dried milk powder was below the intended amount and that the quantities supplied were not always used for the babies for whom they were given. It is thus possible that many of these children suffered in fact from insufficient food supply and that this nutritional factor was the reason for their high diarrhoea morbidity. Another reason might have been contamination of the milk powder solution during its preparation at home. In the long-term survey, these and other factors possibly connected with the feeding of milk powder will be studied. It is worth noting that in a recent publication of WHO, JELLIFFE (1955) mentions a possible association between diarrhoea in infants and the feeding of milk powder in various subtropical and tropical regions.

(v) *Morbidity by Hygienic Conditions in the Home.* We were understandably interested in trying to find correlations between hygienic factors in the home and the diarrhoea morbidity of the children. Even in the planning stage, we found great difficulties in devising methods for assessing these factors quantitatively. During the survey and when scrutinizing the data collected, we found that our methods had not worked too well and that the quantitative assessment was in many instances rather doubtful. No clearcut correlation between diarrhoea morbidity and hygienic conditions emerged.

We do not think that our inconclusive results prove that hygienic conditions are of no importance in diarrhoea morbidity, but only that our technique of assessing these factors was inadequate and in some regards even faulty. We shall touch on this question again in the final discussion.

(vi) *Diarrhoea Morbidity and Nutritional Status.* It is a general impression of pediatricians that the malnourished or dystrophic child is more apt to contract diarrhoea than if well-nourished. On the other hand, it is clear that the nutritional status of a child will suffer by long attacks of diarrhoea, so that, at a given moment, it is difficult to decide whether the malnutrition is due to the diarrhoea or vice versa. Only longitudinal studies carried out throughout the year and including the non-diarrhoea season of the winter months may give an answer to this involved question. It was clear to us from the beginning that, within the framework of the 4-months pilot study, we could not hope to obtain much data on the influence of this host factor on the diarrhoea morbidity of children.

We analysed morbidity in relation to the birth-weights of the children, grouping them as follows : under 2,000 grammes, 2,000-2,500, 2,500-3,000, 3,000-3,500, 3,500-4,000, and over 4,000 grammes. Within the range 2,500-4,000 and over, no significant differences in average duration were observed.

DISCUSSION

As already mentioned in the introduction, the present short-term study was considered a pilot experiment useful for the planning of a full year's epidemiological study which is already underway at the time of writing. In the following account, some interesting epidemiological observations that have resulted from the pilot study are reviewed briefly, as well as the lessons learned for the planning of the present, more extensive survey.

The experience of this survey has confirmed that weekly routine visits and daily follow-up of cases of diarrhoea are essential for obtaining complete and accurate information as to the number of spells and especially their duration.

The high morbidity figures summarized in Table II came as a surprise to medical practitioners and Public Health Officers, in spite of their general awareness of the seriousness of the diarrhoea problem. It is probable that diarrhoea morbidity in our survey population was even somewhat lower than that in comparable population groups, since such frequent visits by a nurse must inevitably have had a beneficial effect on the morbidity, be it through general education of the mothers or through the advice given at the beginning of a spell of diarrhoea.

Our results show no correlation, under the conditions of the survey, between the degree of crowding and diarrhoea morbidity.

It was found that, with the technique used, it has been impossible to define the factors in the hygienic environment specifically correlated with diarrhoea morbidity. It has been the impression of the personnel engaged in this survey that the capability and efficiency of the mother in the handling of the baby is probably a more important factor than the general state of cleanliness of the home. In the framework of the detailed long-term study, specific questions as to the mother's efficiency have therefore been included. The importance of this factor in the morbidity from common childhood diseases was emphasized also in the Newcastle study " A Thousand Families " (SPENCE et al., 1954).

We do not consider that our observations on the relation between type of milk fed and diarrhoea morbidity have established all the facts that can be learned on this problem. However, the observation that the available fresh milk supply, although unsatisfactory from a sanitary point of view, does not carry a higher rate of diarrhoea morbidity than the feeding of milk powder, seems to deserve attention, with the reservations made in the relevant paragraph.

The important problem of the influence of nutritional status on susceptibility to diarrhoea has been scarcely touched by the observations in this pilot study. We could only establish that birth-weight (within the range of 2,500 to 4,000 grammes) has no influence on diarrhoea morbidity, i.e., there is no marked prenatal influence. In the long-term study children will be weighed at regular intervals, and in this way it will be possible to assess nutritional status.

With regard to specific causative agents, no attempt was made in the pilot study to carry out bacteriological examinations. However, studies of this nature on large series of cases of infantile diarrhoea have been carried out in hospitals here by SINGER et al. (1955), and no particular causative agent could be incriminated. Findings of Shigella and Salmonella organisms were extremely rare in their cases, and pathogenic coli organisms (0111, 055) were not found in a higher proportion of diarrhoea cases than in normal children of the same age. Although we consider that environmental and host factors are probably far more important in the epidemiology of infantile diarrhoea than specific agents, laboratory studies of the intestinal flora of the child population in general, as well as in the diarrhoea cases, have been included in the long-term survey at present being undertaken.

SUMMARY

Morbidity from infantile diarrhoea is still high in Israel, particularly amongst the new immigrant population A pilot study was carried out in 649 immigrant children under the age of 3 years during four summer months Attacks of diarrhoea and their duration were determined through weekly visits by nurses and were recorded together with certain environmental and social data on the families.

The average number of spells of diarrhoea during the four months' period was 1 62 per child and the average duration 11 24 days per child Infants below the age of six months and children above two years had a markedly lower morbidity than children between six months and two years

Differences in diarrhoea morbidity were found according to the country of origin of the children's families Children of lower socio-economic classes had higher diarrhoea morbidity. No correlation was found between diarrhoea morbidity and the degree of crowding

There was a marked correlation between diarrhoea morbidity and the type of milk fed In the age-group 0-5 months, breast-fed babies had less diarrhoea than others, while in older children those fed with fresh milk had less diarrhoea than those fed with milk-powder solutions Birth-weight within the range 2,500 to 4,000 grammes showed no influence on the morbidity. The necessity of more intensive study of these and some additional host and environmental factors was made clear by this pilot study and valuable knowledge acquired for the planning of a long-term survey

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CORRESPONDENCE

To the Editor

SIR,—I read with interest the paper by Ethel Nurge on " Infant Feeding in the Village of Guinghandan, Leyte, Philippines." It is not my intention to discuss this paper here, but rather to emphasize that Leyte is one of the smaller islands in the Philippine archipelago, and is relatively underdeveloped, even compared with nearby islands, such as Panay and Cebu. There are no industries or large urban centres on the island ; while the incidence of infection with *S. japonicum* and the hookworm is high.

It is, then, timely to note the wide variety of different situations found in the Philippines, where, it must be recalled, there are over seventy different dialects, all associated with different customs in all respects.

Even in the main island of Luzon, there are different dialects and culture patterns. However, industrialization is progressing rapidly, and, as the traffic between Manila and other parts of Luzon increases, so ideas on infant feeding are changing. One problem of importance is that of prolonged and *exclusive* breast-feeding, which can result in iron deficiency anaemia, hypoproteinaemia, lack of vitamin C and, possibly, even sodium deficiency. In our experience in Manila, however, artificial feeding is given rather soon in the majority of cases, although only in the form of canned milk, while vegetables and fruits are neglected. Mothers frequently prefer condensed milk, which may then be so much diluted that the result is virtually water faintly coloured with milk. As elsewhere in the world, poverty is a very important factor in the etiology of malnutrition, even in Luzon.

The Institute of Nutrition is doing its best to improve the dietary habits of all age groups, and, for this and other purposes, health centres have been established even in the small islands, so that advice on infant feeding can become available to mothers.

General Hospital, Manila. EUGENE STRANSKY.

NOTICES

THE CHILD IN THE FAMILY

The International Union for Child Welfare in cooperation with the Children's Bureau of the Ministry of Health and Welfare, Japan, is to hold a Study Conference on " The Child in the Family," in Tokyo, from November 23rd to 27th, 1958.

Full details may be obtained from the International Union for Child Welfare, 1, rue de Varembé, Geneva, Switzerland.

First Asian Regional Paediatric Congress

This will be held in Singapore from May 26-30th, 1958. Further details are obtainable from the Organizing Secretary, The Paediatric Unit, General Hospital Singapore 3.

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THE

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EDITORIAL

THE ARBOR VIRUSES

The arthropod-borne (Arbor) animal viruses have the distinguishing property of multiplying in nature in the bodies of arthropods without occasioning obvious tissue damage or disease. Transmission of these agents to man or other hosts, such as other mammals or birds, takes place through an arthropod bite : and the carrier, in turn, becomes infected by the ingestion of blood from a host at the time when a virus is present in the latter's peripheral circulation.(1)

Although much remains to be known concerning the clinical effects and epidemiology of the Arbor viruses, it is likely that they are often of considerable significance to the tropical pediatrician.

As noted by Casals in his recent excellent review of the subject, antigenically many of these arthropod-borne viruses are related and can be assigned to different groups, of which two are the most important.(1) Group A contains the following viruses—three varieties of Equine encephalomyelitis (Eastern, Western and Venezuelan), Semliki Forest, Sindbis etc. : while within Group B are to be found the following viruses — Dengue, Japanese B encephalitis, Louping ill, Yellow fever, Murray Valley encephalitis, Zika, West Nile, Uganda S, St. Louis encephalitis, Ilhéus and several others.

The fact that there is a group relationship between the antibodies produced by viruses within these two groups has practical significance. For example, special care has to be given to the interpretation of the results of the serological surveys which are nowadays being undertaken in various tropical regions. Infection with one member of Group B will lead, after some weeks, to a marked antigenic cross-reaction with raised antibodies produced against all members of the group, so that *precise* definition of a locally-prevalent disease may be difficult.

Another aspect of this subject of great interest is the possibility of protective action of group antibodies in human infection. While this certainly appears to be so in experimental animals, it is not too far-fatched to consider whether the failure of Yellow fever to spread to the crowded, Aedes-infested subcontinent of India may not partly be related to the universal presence in the population of high titres of antibodies produced by other antigenically related members of Group B.

As already mentioned, the widespreadness and clinical significance of these viruses is not known and much further investigation is needed. However, reports from different parts of the world suggest that these infections have an extensive distribution and quite often are causes of non-specific febrile illness and, in some at least, of encephalitis, often affecting children. Perhaps one of the best documented examples of the latter, is the recent description of outbreaks of Japanese B encephalitis in Southern India. Numerous papers have been published on the subject, as, for example, by WEBB and PEREIRA who report a series of cases from the State of Madras, which showed a 50 per cent. mortality rate.(2)

In a widely geographically distant part of the world, the West Indies, the possible significance of the Arbor viruses is also much under consideration, and the finding of the virus of St Louis encephalitis in Trinidad by ANDERSON and his colleagues is especially important.(3) It has long been suspected that the occasional cases of encephalitis seen in the Caribbean may be related to the seasonal migration of birds between North and South America, thereby perhaps, introducing the various types of Arbor virus which have birds as animal reservoirs.

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NOTICE

IX International Congress of Paediatrics

The IX International Congress of Paediatrics will be held in Montreal, Canada from July 19 - 25, 1959, under the auspices of the International Paediatric Association at the invitation of the Government of Canada and the Canadian Paediatric Society.

The scientific programme has been planned to embrace the problems of child care in their broadest sense, and will include plenary sessions, panel discussions, original communications and scientific exhibits. Sessions will be devoted to problems of tropical child health. Simultaneous interpretation will be employed for all plenary sessions. Official languages will be English, French and Spanish.

A varied programme of social events will be offered. Canada's bilingual metropolis is one of the cosmopolitan centres of North America and has many scientific, artistic, cultural and educational attractions, including two universities and two modern Children's Hospitals. The Laurentian Mountains and the St. Lawrence Seaway are both close to this charming city.

The Preliminary Programme and registration forms will be distributed in a few months time by the regional offices of the American Express Company. Further information may be obtained from Box 215, Westmount, Montreal, Canada.

NUTRITIONAL STUDIES ON BREAST MILK OF NIGERIAN WOMEN

(Changes in the Major Constituents of Breast Milk During a Single Feed)

by

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Most of the earlier observations on the variation of the composition of human milk, during a feed, have been made on fore- and after-milk (DENIS and TALBOT, 1919a ; CARTER and RICHMOND, 1898 ; SALMI, 1944). Some workers divided the milk into three parts : first, middle, and last (WAISMAN and PETAZZE, 1947 ; LOWENFELD et al, 1927 ; VINCENT and VIAL, 1933). Only a few researchers have investigated successive fractions of milk obtained during a nursing (LUCIGNANI, 1934 ; HYTTEN, 1954).

LUCIGNANI (1934) removed his specimens at one minute intervals and found that the fat content rose to a maximum in 10 minutes, and declined slightly in the next 5 minutes. HYTTEN (1954) used a pumping machine and collected serial 12 ml. samples until the breast was empty. These samples were then analysed for fat, lactose, total nitrogen, and casein. All the subjects, from whom milk was obtained, were in their first month of lactation.

In the present study, observations were made on Nigerian women in various stages of lactation, up to a year. The concentrations of calcium and inorganic phosphate, as well as of "cream", protein, non-protein nitrogen, and lactose, were determined at various stages during a feeding.

METHODS

(a) *Milk sampling.*—Samples were collected at the 6 a.m. feeding time. The milk was manually expressed from the left breast into successive, 10 ml. calibrated test tubes, until the gland was empty. The baby fed normally from the right breast. This procedure was deemed adequate since HYTTEN'S (1954) results showed no difference in the general trend of variation, as between the left and right breast of any one individual.

(b) *Estimation of the Constituents.*—The analytical procedure which was followed in the determination of lactose, total nitrogen, "cream", calcium, and inorganic phosphorus have been described in a previous paper (BASSIR, 1956). To obtain non-protein nitrogen, 2 ml. milk was mixed with 2 ml. 20% trichloroacetic acid, and the mixture filtered after standing for 30 minutes. 2 ml. of the clear filtrate (1 ml. milk) was then subjected to our routine micro-Kjeldahl procedure for nitrogen estimation. The difference between the total nitrogen value and that for non-protein nitrogen was assessed as protein nitrogen.

(c) *Experimental subjects.*—The women studied in the present work came from the "lower middle class" in Ibadan, whose staple diet is cassava and beans cooked in red palm oil, together with a little fish or meat. In general, the dietary is adequate with respect to calories, although low in animal protein. The babies were fed "on demand," except during the actual period of the experiment.

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* The author is indebted to Mr. Lawrence Okoro for technical assistance, and to the Department of Pediatrics, University College, Ibadan, for invaluable help with the collection of the milk samples.

RESULTS

Variations in the concentration of each of the constituents are shown in Tables I—VI.

Calcium. It can be seen that the range of values for calcium varies considerably from individual to individual. There appears to be a tendency for the values to decrease towards the end of a feed ; but this is not borne out by the block graphs of means shown in Fig. 1.

Inorganic Phosphorus. Changes in the concentration of inorganic phosphorus, during a nursing, run parallel with those of calcium (Fig. 1), although the variations appear to be reversed at the very end of the feed.

Cream. In most cases, the concentration of cream rose from the beginning to the end of a nursing. But, in one or two instances, a reverse trend was observed. Fig. 2 shows three characteristic trends in the cream concentration: (a) a progressive rise; (b) a step-wise rising ; (c) an irregular decrease. When the amounts of cream in the first and last samples of all the experiments are analysed statistically, they are found to belong

TABLE I. Calcium (mg./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	31	2	19.5	18.5	18.0	19.5	18.5	18.0			
3	24	2	14.5	17	16	15.5	17.5	14.5			
4	24	1	24.8	25	21	25.5	21	23			
5	36	2	25.3	24	24	25					
6	6	2	15.5	15.5	15.5	15.5					
7	40	3	21	23	23	23.5	24.5	24.5	23		
8	32	3	17.3	17.5	18.3	19	16.3	18	18.2		
9	32	3	21.5	25.2	25	25.5	26.5	20.5	24.8		
10	2	2	15	17.5							
11	8	1	24.7	23.5	23.3	22.5	21	21	21	21	20.8
12	16	3	15	15.5	16	14	20	15			
13	40	1	19	17	16	15	15.5	14			
14	16	1	20	19	19						
15	1	2	11.5	11							
16	36	2	16	13	16	16.5	15.5	13.5			
17	1	2	16	14.5	14.5	15	15.5	15			
18	1	7	39	31.5	32	31	31	36	31		
19	7	2	36	31	32						
20	28	3	17.5	17.5	18	16.5	18.5	17			
21	36	6	34.5	32.5	31	34	35.5				
22	1	3	21	19.5	25	19					
23	78	1	19	18	18.5						
24	40	2	19.5	18	17.5	17.5	19	17			
25	28	4	16.5	25	18	25.5	19.5	17			
26	3	5	17	17.5	16.5	17	17.5				
27	2	3	14.5	15.5	14.5	15.5	15.5	15	13.5		
28	44	1	13.5	12.5	13.5	13.5	14.5	12.5	13.5		
29	2	3	20.5	20	21.5	20.5	20.5	20.5	18		
30	2	3	22.5	20.5	24.5	20.6	21	21	18.5		
31	44	3	36	35	32	38	45	39.5	39		
32	1	1	15.5	20	14.2	19	16.2	17			
33	3	1	12.5	12.5	13	16	17	17	17		
34	1	3	19.5	20.5	23	23.5	21.6				
35	2	1	19.5	21	23.5	22.5	21.2	22.5	21.5		
36	20	4	18.5	18.3	17	16.7	18.5	17	15.7		
37	1	1	15.8	15.5	14	14.5	13.5	13.5	13.7		

to different numerical populations, with a " t " value of 6.62. This difference is highly significant at the 0.1 per cent level.

Non-protein nitrogen. The results for non-protein are complex. The difficulty is shown graphically in Fig. 3. There is an irregular trend, which is less marked in the middle samples. A sharp rise at the end is also indicated.

Total Protein. The total protein value is obtained as the product of multiplying the protein nitrogen figure by 6.37. Fig. 3 shows that there is little or no variation in the concentration of total protein during a feeding.

Lactose. The variation of lactose content with sample number, is illustrated in Fig. 4. There is no general fall in the concentration of this sugar from the beginning to the end of a nursing. The lactose determination was done on whole milk with its varying aqueous phase. This is probably responsible for the wide scatter of lactose values obtained and for the fact that the mean of these values is approximately constant.

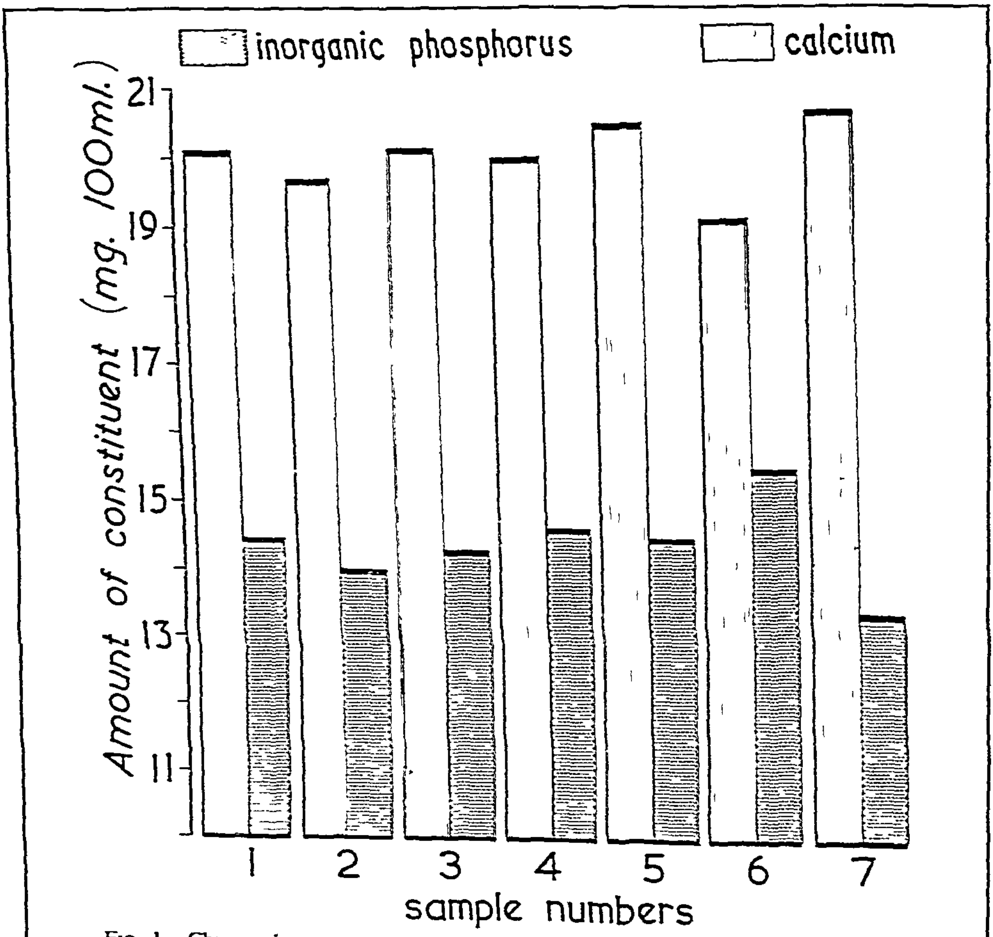

FIG. 1. Changes in concentration of calcium and phosphorus during a single feed.

RESULTS

Variations in the concentration of each of the constituents are shown in Tables I—VI.

Calcium. It can be seen that the range of values for calcium varies considerably from individual to individual. There appears to be a tendency for the values to decrease towards the end of a feed ; but this is not borne out by the block graphs of means shown in Fig. 1.

Inorganic Phosphorus. Changes in the concentration of inorganic phosphorus, during a nursing, run parallel with those of calcium (Fig. 1), although the variations appear to be reversed at the very end of the feed.

Cream. In most cases, the concentration of cream rose from the beginning to the end of a nursing. But, in one or two instances, a reverse trend was observed. Fig. 2 shows three characteristic trends in the cream concentration: (a) a progressive rise; (b) a step-wise rising ; (c) an irregular decrease. When the amounts of cream in the first and last samples of all the experiments are analysed statistically, they are found to belong

TABLE I. Calcium (mg./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	31	2	19.5	18.5	18.0	19.5	18.5	18.0			
3	24	2	14.5	17	16	15.5	17.5	14.5			
4	24	1	24.8	25	21	25.5	21	23			
5	36	2	25.3	24	24	25					
6	6	2	15.5	15.5	15.5	15.5					
7	40	3	21	23	23	23.5	24.5	24.5	23		
8	32	3	17.3	17.5	18.3	19	16.3	18	18.2		
9	32	3	21.5	25.2	25	25.5	26.5	20.5	24.8		
10	2	2	15	17.5							
11	8	1	24.7	23.5	23.3	22.5	21	21	21	21	20.8
12	16	3	15	15.5	16	14	20	15			
13	40	1	19	17	16	15	15.5	14			
14	16	1	20	19	19						
15	1	2	11.5	11							
16	36	2	16	13	16	16.5	15.5	13.5			
17	1	2	16	14.5	14.5	15	15.5	15			
18	1	7	39	31.5	32	31	31	36	31		
19	7	2	36	31	32						
20	28	3	17.5	17.5	18	16.5	18.5	17			
21	36	6	34.5	32.5	31	34	35.5				
22	1	3	21	19.5	25	19					
23	78	1	19	18	18.5						
24	40	2	19.5	18	17.5	17.5	19	17			
25	28	4	16.5	25	18	25.5	19.5	17			
26	3	5	17	17.5	16.5	17	17.5				
27	2	3	14.5	15.5	14.5	15.5	15.5	15	13.5		
28	44	1	13.5	12.5	13.5	13.5	14.5	12.5	13.5		
29	2	3	20.5	20	21.5	20.5	20.5	20.5	18		
30	2	3	22.5	20.5	24.5	20.6	21	21	18.5		
31	44	3	36	35	32	38	45	39.5	39		
32	1	1	15.5	20	14.2	19	16.2	17			
33	3	1	12.5	12.5	13	16	17	17	17		
34	1	3	19.5	20.5	23	23.5	21.6				
35	2	1	19.5	21	23.5	22.5	21.2	22.5	21.5		
36	20	4	18.5	18.3	17	16.7	18.5	17	15.7		
37	1	1	15.8	15.5	14	14.5	13.5	13.5	13.7		

to different numerical populations, with a " t " value of 6.62. This difference is highly significant at the 0.1 per cent level.

Non-protein nitrogen. The results for non-protein are complex. The difficulty is shown graphically in Fig. 3. There is an irregular trend, which is less marked in the middle samples. A sharp rise at the end is also indicated.

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Lactose. The variation of lactose content with sample number, is illustrated in Fig. 4. There is no general fall in the concentration of this sugar from the beginning to the end of a nursing. The lactose determination was done on whole milk with its varying aqueous phase. This is probably responsible for the wide scatter of lactose values obtained and for the fact that the mean of these values is approximately constant.

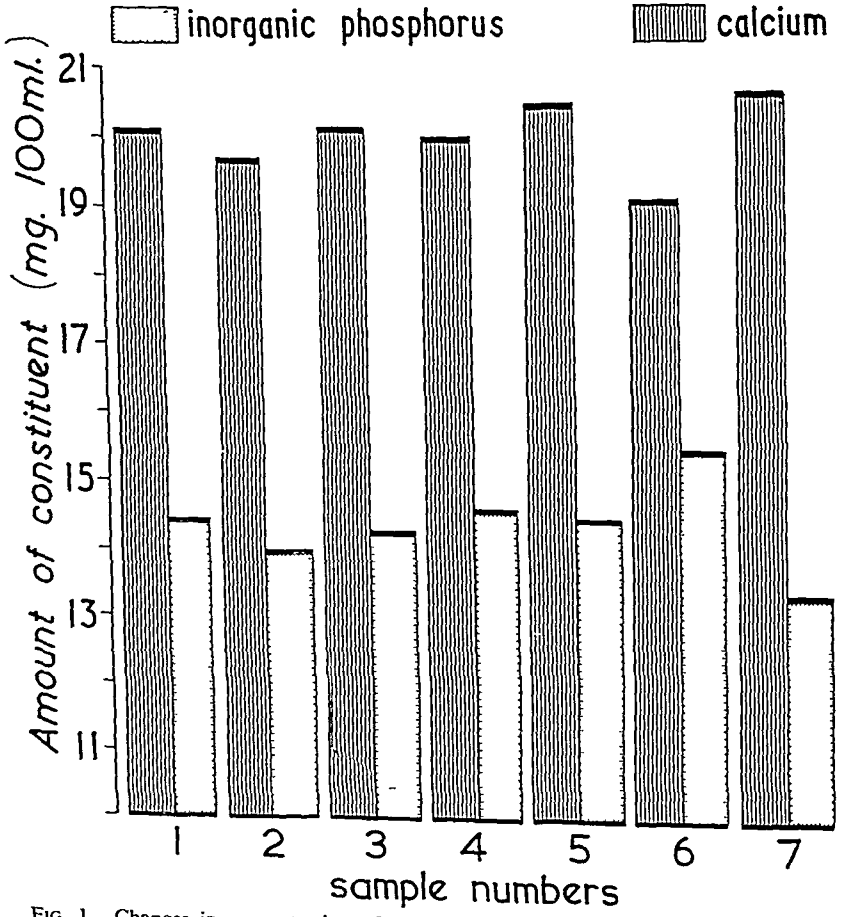

FIG. 1. Changes in concentration of calcium and phosphorus during a single feed.

DISCUSSION

One tentative conclusion that may be drawn from the calcium results is that the concentration of this element is fairly constant for most of the feed. Towards the end, this pattern changes by becoming irregular. The mean value of the penultimate sample is probably significantly lower than the average of the last samples. But it is unlikely that the mean of the series of last three samples is statistically different from that of the first four.

The close relationship, which is shown (Fig. 1) between the trends of calcium and phosphorus concentratioh in most of the samples, is not unexpected. The high value of the penultimate phosphorus average, which is followed by a sharp fall, runs counter to the calcium trend. It suggests that it is valid to use the population average of the means of the last three samples for the purpose of comparison with the means of the earlier samples.

The results of the milk analysis, for cream, show practically the same pattern as that

TABLE II. Phosphorus (mg./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
2	44	4	14.7	14.7	13.9	14.7	15.5	12.4			
3	44	2	13.2	13.2	13.6	14.7	16.3	15.5			
4	24	1	14	16.3	15.7	13.2	16.5	15.7			
6	6	2	11.5	12.5	10.5	11.5					
7	40	3	12.4	10.7	14.8	14.3	17.3	19.8	13.2		
8	32	3	6.9	3.8	8.5	13.9	9.2	10.2	9.2		
9	32	3	16.2	16.9	8.5	3.9	11.5	13.1	8.8	12.3	
10	2	2	8.3	11	8.3						
11	8	1	12.2	13.8	13.8	15.1	13.8	20.6	17.9	15.1	16.5
12	16	2	12.1	12.1	11.7		12.8	11.7			
13	40	1	12.4	12.8	12.8	12.4	12.8	11.9			
14	16	1	12.6	12.6	12.4						
15	1	2	12.1	13.5							
16	36	2	10.6	12.5	11.2	12.5	10				
17	1	2	18.1	17.5	18.7	18.1	19.4	18.7			
18	1	7	11.2	9.9	12.5	11.9	12.5	12.5	11.2		
19	7	2	12.5	17.5							
20	28	3	12.5	15	16.2	16.9	15	14.4			
21	36	6	20.6	22.0	20	15.0	19.4				
22	1	3	14.2	17.6	16.1	12.3					
23	78	1	17.1	18.5	19.4						
24	40	2	15.2	18.8	19.4	18.8	16.3	18.5			
25	28	4	19.0	17.1	15.7	19.9	16.1	15.2			
26	3	5	10	8.8	10	10	8.8				
27	2	3	10.6	7.5	14.4	13.1	8.7	10.6	11.2		
28	44	1	11.2	5	11.2	8.8	8.1	7.5	6.2		
29	2	3	11.5	10.5	8.2	9.2	14	14	13.8		
30	2	3	12	12.5	14.7	14.2	12.5	14	10		
31	44	3	24.0	24.0	22.5	28.0	27.0	28.0	24.0		
32	1	1	14.5	12.5	11.0	12.5	13.0	15.0	13.0		
33	3	1	16.2	16.5	17.0	12.0	15.0	14.2	16.0		
34	8	3	24.5	21.2	20.5	18.8	19.8				
35	12	1	20	22	17.5	27	24.5	21.5	21.5		
36	20	4	13.8	18.8	19.5	18.8	18.2	15	16.2		
37	1	1	19.5	17.7	18.8	12.5	11.3	17.5	19.5		
38	52	1	10.5	9.5	10	10	10	10	9.5		11
39	32	1	6.5	7.2	10	8.2	7.5	8	8.5		6

obtained for fat by HYTTEN (1954). It further confirms the observation of many previous workers that after-milk is richer in fat than fore-milk. The mechanism of the absorption of fat on the alveolar and duct surfaces, which has been experimentally demonstrated by HYTTEN using a rubber sponge, will explain most of the changes of cream content that occur during a nursing. Fig. 5 gives the types of curves which have been obtained by immersing a rubber sponge in Nigerian milk and then squeezing out the milk into 10 ml. consecutive fractions. In no case was it possible to obtain the reverse trend which is illustrated in the third curve in Fig. 2. This stresses the limitation of HYTTEN's hypothesis, and it suggests that a combination of factors may be responsible for the changes in fat content which occur during a feeding. These factors include differences in viscosity between the fat globules and other suspensoids (GOLZ, 1946) ; the method of milk extraction (VON SYDOW, 1944) ; and the effect of a possible reflex which acts on fat secretion during a feeding (VINCENT and VIAL, 1944).

In the majority of the experimental subjects, the non-protein nitrogen (N.P.N.) tended to decrease from the first to the second half of a nursing, but there was usually a terminal rise as well (Fig. 3). It is possible that the irregular pattern of the N.P.N. changes

TABLE III. Cream (g./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	32	2	3	6	6	6	8.5	9			
2	44	4	3.5	3.5	3.5	5	6.5	6			
3	24	2	3.5	5	3.5	2.5	3.5	2.5			
4	24	1	5.5	5	7	7	10	10			
5	36	2	5	5	4.5	5					
6	6	2	2.5	4.5	5.5	5.5					
7	40	3	2.5	3	4	4.5	5	5	5		
8	32	3	3.5	3.5	3	3.5	4.5	5.5	18		
9	32	3	27	28	28	29	30	5	8		
10	2	2	6.5	7.5	7.5						
11	8	1	3.5	3.0	3.5	5	6.5	6.5	6.5	5.5	7
12	16	3	57	57.5	8.5	8.5	8.5	9			
13	40	1	3.5	5.5	5.5	7.5	7.5	8.4			
14	16	1	3.5	4.0	5.0						
15	1	2	3.5	3.5							
16	36	2	3.6	4.5	4.5	5.0	5.0	7			
17	1	2	7.5	8	9	9	10.5	10			
18	1	7	5.5	6	7	7.5	7.8	8	8.5		
19	7	2	8.5	12	12						
20	28	3	6.5	2	6	6	5	3.5			
21	36	6	8	8.5	7.5	5	5.5				
22	1	3	5	7.5	6.5	7.5					
23	78	1	3.6	3.5	4						
24	40	2	2	2.5	2.5	4	3.5	2.5			
25	28	4	1.5	2.5	2.5	2.5	2.5				
26	3	5	5	5.5	6	9.5	10.5				
27	2	3	6.5	6.5	7	7.5	8.5	8.3	9.8		
28	44	1	8.0	9.0	8.5	8.5	8.5	11.5	12.2		
29	2	3	3.5	3.5	3.5	3.5	5	4.5	6.5		
30	2	3	6.5	6.5	8	8	10	10	12		
31	44	3	5.5	6.5	6.5	6	6.5	7.5	7.5		
32	1	1	10	10.5	10	11.5	10	11.5	12		
33	3	1	5.5	5.5	3.5	2.5	2.5	2	2		
34	8	3	6	3.5	5	4.5	4.5				
35	12	1	3	4.5	3	4	4	4.5	4.5		

is related to the variations in lipid content (HYTTEN, 1954). Since the ratio of N.P.N. to total nitrogen is usually less than 1 : 5, the observed haphazard variation of N.P.N. is unlikely to be of particular nutritional significance.

It is interesting to observe that the protein content of Nigerian breast milk hardly varies during the course of a feed (Fig. 3). This result is in accord with that of CARTER and RICHMOND (1898), LOWENFELD et al. (1927), WAISMAN and PETAZZE (1947) and HYTTEN (1954). The largest differences recorded by WAISMAN and PETTAZZE (1947) between the means of first and last samples, in 16 nursings, was 4.4 per cent. Using this figure as the basis of his calculation, and assuming a standard deviation of stages of nursing about

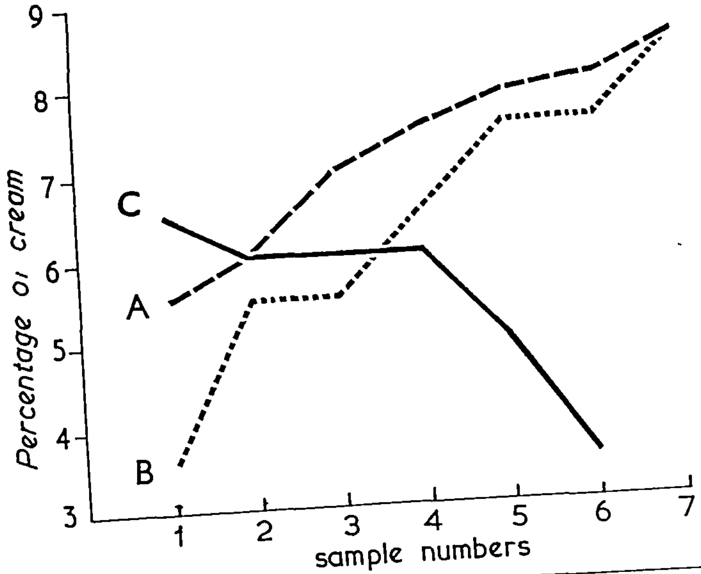

FIG. 2. Trends in cream content during a feed.

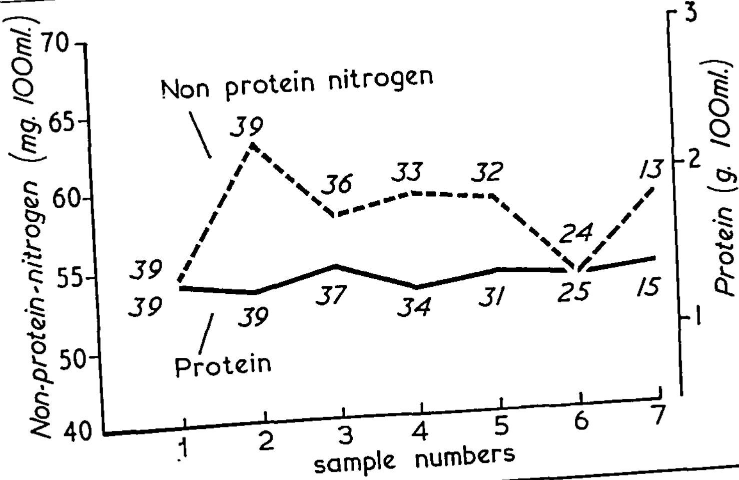

FIG. 3. Serial means of the protein and non-protein nitrogen values for all the experimental subjects. (The figures on the graphs indicate the number of subjects involved).

the mean to be 162.7±6.4 mg. N., MORRISON (1952) estimated that the baby would be deprived of only 1.9 per cent. of the potential amount of milk protein nitrogen available, as the consequence of a decrease in the concentration of nitrogen during a nursing ; whereas, a 9 per cent. loss would be suffered through changes in the volume. The conclusion, therefore, is that the decrease in the amount of protein during a feed, which is reported by some authors, is of practically no nutritional significance.

In the lactose experiments on Nigerian women, changes amounting to 40 per cent. of the initial concentrations of the sugar were observed in some cases (Table III). Yet, our results failed to show a consistent downward trend during the course of a feeding (Fig. 4). HYTTEN (1954) claimed that the lactose content of breast milk was inversely proportional to the lipid content during a feeding. But only 14 sets of results were involved, and these do not indicate statistically significant downward variation. Also, the maximum fall of lactose concentration which was recorded by HYTTEN was from 6.60

TABLE IV. Non-Protein Nitrogen (mg./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	32	2	32.5	30	3.1	32.5	31.5	31			
2	44	4	43	67	43.2	88	42	42			
3	24	2	52	88	45	38.5	46.5	34.5			
4	24	1	40	25	45.5	43.5	26.1	41			
5	36	2	50	40	42.5						
6	6	2	65	57	48.5	39					
7	40	3	25	39.5	40.5	36.5	33.5	31	32.5		
8	32	3	37	41	26	29.0	60				
9	32	3	41	30	42.5	45	62	60			
10	2	2	86	69							
11	8	1	62	43	45	53	47	50	43	56	
12	16	3	50.5	52.5	51	50.5	51	47.5			
13	40	1	47.5	52.5	38	42.5	40	52.5			
14	16	1	52.5	57.5	65						
15	1	2	67.5	53							
16	36	2	45	85	60	43	85				
17	1	2	52	57	52	53	52	52			
18	1	7	80	80	75	82	85	85	62		
19	7	2	52	65							
20	28	3	43	46	46.7	47	47.5	85			
21	36	6	110	105	120	115	110				
22	1	3	72	75	80	105					
23	78	1	3.72	3.75	4.52						
25	28	4	1.75	1.69	1.71	1.69	1.69				
26	3	5	1.78	1.37	1.65	1.92	2.39				
27	2	3	2.39	1.84	2.45	2.48	3.02	2.26	2.50		
28	44	1	1.53	1.43	1.43	1.56	1.11	1.43	1.78		
29	2	3	1.56	1.62	1.53	1.56	1.69	1.34			
30	2	3	1.94	3.18	3.40	3.31	2.99	2.99	2.35		
31	44	3	60	55	57.5	56	56.5	62.5	55		
32	1	1	42.5	45	43.5	45.5	46.5	46.0	42.5		
33	3	1	55	50	60	47.5	47.5	42.5			
34	8	3	55	50	49.5	43	42.5				
35	12	1	45	46	42.5	50	47	42.5	44.5		
36	20	4	57.5	49.5	52.5	44.5	49.5	55	50.5		
37	1	1	41	42.5	45.5	48	46	48.5	55		
38	52	1	47.5	46.0	46.5	52.0	42.5	45	48.0	44.5	
39	32	1	55	62.5	49.5	57	44.5	55.5	62.5	52	

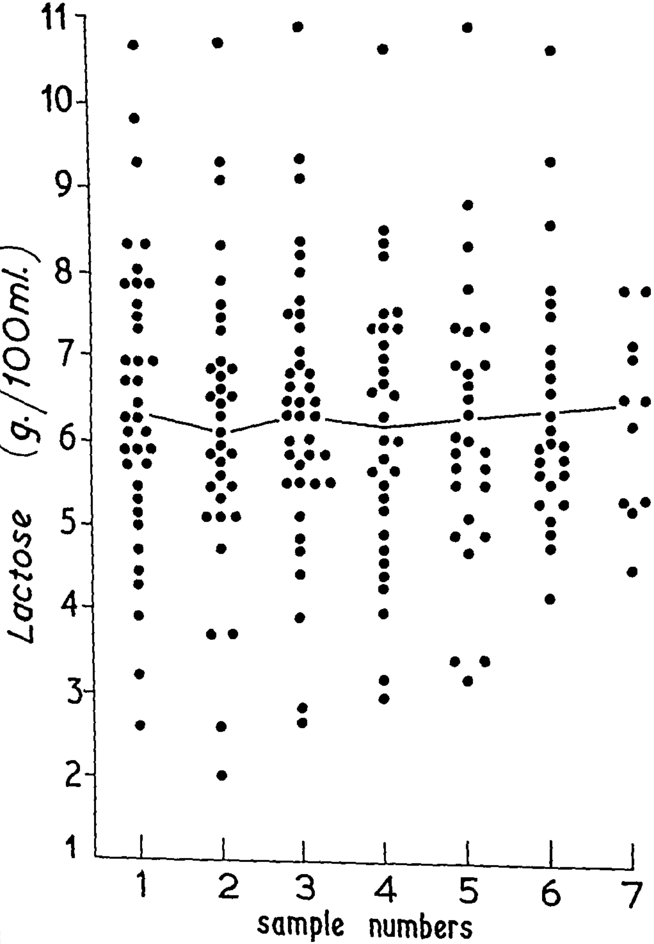

FIG. 4. Variations in the lactose content of milk.

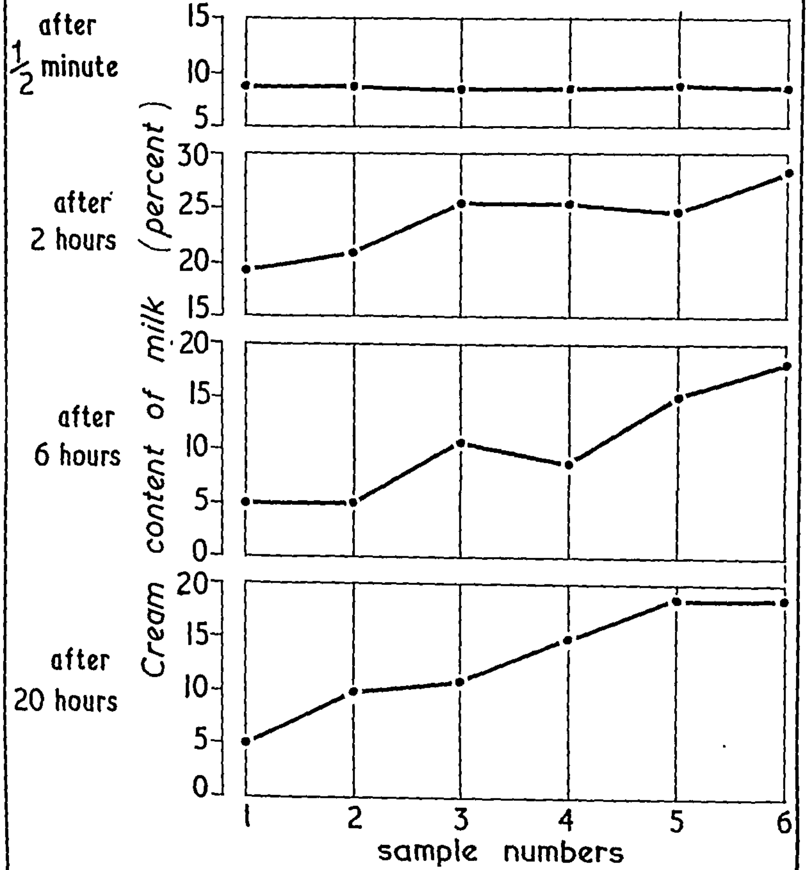

FIG. 5. The effect of immersing a rubber sponge in milk for varying periods.

g. to 5.65 g. per 100 ml. (14.4 per cent.). And this corresponded to a fat increase of 354 per cent. of the initial value. NOVELLIS DI COARAZZE (1936) found a variable pattern in the trend of lactose value during a nursing. Fifteen out of his 20 cases showed a fall from the initial values, followed by a partial recovery later. However, this observation, as well as those of DEEM (1931), and DENIS and TALBOT (1919b), were not statistically significant. It thus seems that the variation of the lactose content of breast milk during a feeding is not nutritionally significant.

SUMMARY

The variations, during a single feeding, of the concentrations of lactose, non-protein nitrogen, total protein, calcium, inorganic phosphorus, and cream have been studied in 39 Nigerian women at various stages of lactation. Thus some 1,500 separate results were obtained. The results have been analysed in the light of previous work, and with regard to their possible significance in infant nutrition.

TABLE V. Total Protein (g./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	32	2	0.6	0.47	0.50	0.63	0.53	0.61			
2	44	4	1.01	0.87	1.01	0.76	1.17	1.07			
3	24	2	0.18	0.45	0.39	0.53	0.49	0.58			
4	24	1	1.55	2.43	3 42	1.95	3.97	2.97			
5	36	2	1.16	1.22	1.18	1.13					
6	6	2	0.87	0.79	1.0	1.0					
7	40	3	1.05	0.91	0.87	0.92	1.09	1.12	0.95		
8	32	3	0.64	0.38	0.73	0.68	0.39	0.55			
9	32	3	2.64	2.29	2.83	1.27	2.98	1.96			
10	2	2	2.45	1.66	1.78						
11	8	1	1.15	1.24	1.2	1.11	1.18	0.79	1.18	1.14	1.03
12	16	3	0.9	1.05	0.8	1.06	0.8	1.18			
13	40	1	0.95	1.24	1.11	1.02	0.9	1.02			
14	16	1	1.02	0.92	0.84						
15	1	2	1.54	1.79							
16	36	2	1.1	0.9	0.94	1.31	1.04				
17	1	2	1.54	1.34	1.31	1.14	1.25	1.34			
18	1	7	1.53	1.65	1.88	1.76	1.58	1.68	1.31		
19	7	2	1.41	1.94							
20	28	3	0.98	0.95	0.83	0.95	1.08	0.68			
21	36	6	1.33	1.62	1.35	0.78	1.16				
22	1	3	2.47	2.26	2.49	2.86					
23	78	1	3.17	3.35	4.04						
24	40	2	1.88	1.55	1.44	1.35	1.35				
25	28	4	1.39	1.34	1.28	1.27	1.35				
26	3	5	1.14	0.72	1.13	1.29	1.78				
27	2	3	1.56	0.92	1.64	1.71	2.23	1.62	1.62		
28	44	1	1.0	1.03	0.98	1.14	0.71	0.98	1.33		
29	2	3	1.29	1.32	1.28	1.25	1.32	1.04			
30	2	3	1.66	2.94	3.15	3.03	2.68	2.76	2.11		
31	44	3	2 0	2.01	2 57	2.39	2.35	2.05	1.68		
32	1	1	2.34	2.33	2.37	2.42	2.38	2.42	2.50		
33	3	1	1.03	1.09	0.90	0.72	0.78	0.43	0.81		
34	8	3	1.45	1.26	1.16	1.53	1.55				
35	12	4	1.23	1.20	1.37	1.23	1.05	1.21	1.23		
36	20	4	1.24	1.23	1.11	1.29	1.27	1.45	1.29		
37	1	1	3.94	1.59	1.56	1.43	1.64	1.49	2.49		
38	52	1	0.98	1.03	1.08	0.98	1.11	0.94	0.98	0.97	
39	32	1	0.63	0.69	0.94	0.70	0.78	0.74	0.69	0.76	

TABLE VI. Lactose (g./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	32	2	7.9	7.9	7.5	7.5	7.3	6.8			
2	44	4	4.4	5.8	6.0	6.0	6.0	5.1			
3	24	2	4.4	5.8	6.0	6.0	6.0	5.7			
4	24	1	9.3	9.3	8.2	8.2	8.8	9.3			
5	36	2	8.3	8	6.8						
6	6	2	9.8	9.1	9.1	8.5					
7	40	3	10.7	10.7	10.9	10.7	10.9	10.9	10.7		
8	32	3	7.5	7.5	7.5	7.5	7.8	7.8	7.8		
9	32	3	2.56	2.56	2.78	2.99			6.0	5.8	
10	2	2	6.4	5.3							
11	8	1	7.4	6.8	7.3	7.3	7.3	5.9	7.1	6.8	6.6
12	16	3	6.1	6.3	6.3	4.9	4.7	4 9			
13	40	1	6.1	6.4	6.8	6.3	6.9	6.9			
14	16	1	6.5	5.8	5.4						
15	1	2	5 8	5.1							
16	36	2	6.9	6.5	5.8	6.7	6.7	6.6			
17	1	2	6.9	6.6	6.5	6.6	6.5	6.2			
18	1	7	5.2	4.7	4.8	4.7	4.9	4.8	4.5		
19	7	2	5.1	5.60	6.3						
20	28	3	7.6	6.7	6.9	7.2	7.3	7.6			
21	36	6	6.81	6.8	6.8	6.9	6.9				
22	1	3	6.3	3.7	4.7	4.7					
23	78	1	—	6	6.8	6.5					
24	40	2	7.9	5 5	9.3	8.3	8.3	8.6			
25	28	4	6.9	6.9	7	5.8	6.3	7.1			
26	3	5	6.7	7.3	6.7	7.4	5.9				
27	2	3	5.4	5.1	5.1	4.5	5.1	5.1	5.2		
28	44	1	5.5	5.7	5.7	5.7	5.7	5.7	4.8	4.8	
29	2	3	8.0	7.4	7.6	7.3	7.4	7.5	7.8		
30	2	3	6.1	5.9	6.7	6.6	6.6	6.3	6.2		
31	44	3	3.9	6.0	4 4	4.4	4.9	5.8	6.5		
32	1	1	—	3.2	2.0	2.7	2.5	3.2	3.4	3.2	
33	3	1	6.4	3.7	3.9	4.3	3.4	4.2			
34	8	3	5.8	5.1	5.5	5.7	5.8				
35	12	1	5 9	5.3	5.5	5.2	5.7	5.3	5.3		
36	20	4	4.7	5.5	5.5	7.0	5.5	6.0	6.5		
37	1	1	5.0	6.5	5.5	4.0	5.5	5.5	7.0		

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THE PREVALENCE OF RICKETS AT AUTOPSY IN A SUBTROPICAL CLIMATE

(A Pilot Study in Israel)

by

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and

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During recent years, progress in infant welfare has reduced appreciably the incidence of rickets in the temperate zone. On the other hand, there has been a growing realisation that rickets is a relatively common condition in the tropics and subtropics. JELLIFFE (1955) in his review of infant nutrition comments that " a somewhat paradoxical situation has been reached ", and regards rickets as a debilitating and possibly deforming disorder in tropical infants, living in some urban regions, including the Eastern Mediterranean.

Most surveys on the incidence of rickets in warmer climes have been based on clinical diagnosis, though biochemical and radiological studies have been made. With the exception of the report by GILLMAN and GILLMAN (1951) on coloured infants in South Africa, no information on the prevalence of histologically-proven rickets at autopsy outside the temperate zone appears to have been available during recent years. A study on the incidence of rickets in Israeli infants by the authors included clinical, biochemical and radiological examinations. A pilot survey of consecutive postmortem material has now been carried out and the results are reported in this paper.

The climate of Israel is subtropical. Out of a total of 4,436 day-hours during the year, over 3,200 clear sunshine hours are recorded, and this percentage is one of the highest in the world. The hot dry *Hamsin* days lead to a loss in direct sun radiation, however.

MATERIAL AND METHODS

The investigation dealt with 98 unselected consecutive postmortem examinations of infants between 2 days and 2 years of age during the years 1953-1956. The fourth right costochondral junction was examined in each case. The technique included decalcification in 7 per cent nitric acid during 24 hours, preparation of a paraffin block and staining with haematoxylin-eosin. The diagnosis of rickets, as advised by FOLLIS (1943), was based on the following points : (a) regularity and depth of the columns of preparatory cartilage, (b) amount and regularity of regional blood-vessels and (c) degree of deposition of calcium salts and the amount of osteoid tissue. Positive cases of rickets were graded as severe, moderate or slight.

Eleven infants were already dead on arrival at the hospital — " coroner's cases " —

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* We wish to thank Dr. B. Gellei, Head of the Pathology Department, for his help in evaluating the histological preparations, and the Heads of the Paediatric Departments for permission to use their clinical data.

Table VI. Lactose (g./100 ml.)

Case No.	Age Weeks	Parity	Sample Number								
			1	2	3	4	5	6	7	8	9
1	32	2	7.9	7.9	7.5	7.5	7.3	6.8			
2	44	4	4.4	5.8	6.0	6.0	6.0	5.1			
3	24	2	4.4	5.8	6.0	6.0	6.0	5.7			
4	24	1	9.3	9.3	8.2	8.2	8.8	9.3			
5	36	2	8.3	8	6.8						
6	6	2	9.8	9.1	9.1	8.5					
7	40	3	10.7	10.7	10.9	10.7	10.9	10.9	10.7		
8	32	3	7.5	7.5	7.5	7.5	7.8	7.8	7.8		
9	32	3	2.56	2.56	2.78	2.99			6.0	5.8	
10	2	2	6.4	5.3							
11	8	1	7.4	6.8	7.3	7.3	7.3	5.9	7.1	6.8	6.6
12	16	3	6.1	6.3	6.3	4.9	4.7	4 9			
13	40	1	6.1	6.4	6.8	6.3	6.9	6.9			
14	16	1	6.5	5.8	5.4						
15	1	2	5 8	5.1							
16	36	2	6.9	6.5	5.8	6.7	6.7	6.6			
17	1	2	6.9	6.6	6.5	6.6	6.5	6.2			
18	1	7	5.2	4.7	4.8	4.7	4.9	4.8	4.5		
19	7	2	5.1	5.60	6.3						
20	28	3	7.6	6.7	6.9	7.2	7.3	7.6			
21	36	6	6.81	6.8	6.8	6.9	6.9				
22	1	3	6.3	3.7	4.7	4.7					
23	78	1	—	6	6.8	6.5					
24	40	2	7.9	5.5	9.3	8.3	8.3	8.6			
25	28	4	6.9	6.9	7	5.8	6.3	7.1			
26	3	5	6.7	7.3	6.7	7.4	5.9				
27	2	3	5.4	5.1	5.1	4.5	5.1	5.1	5.2		
28	44	1	5.5	5.7	5.7	5.7	5.7	5.7	4.8	4.8	
29	2	3	8.0	7.4	7.6	7.3	7.4	7.5	7.8		
30	2	3	6.1	5.9	6.7	6.6	6.6	6.3	6.2		
31	44	3	3.9	6.0	4.4	4.4	4.9	5.8	6.5		
32	1	1	—	3.2	2.0	2.7	2.5	3.2	3.4	3.2	
33	3	1	6.4	3.7	3.9	4.3	3.4	4.2			
34	8	3	5.8	5.1	5.5	5.7	5.8				
35	12	1	5.9	5.3	5.5	5.2	5.7	5.3	5.3		
36	20	4	4.7	5.5	5.5	7.0	5.5	6.0	6.5		
37	1	1	5.0	6.5	5.5	4.0	5.5	5.5	7.0		

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by

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but the majority of the others had been in-patients with infantile diarrhoea or bronchopneumonia, and in many cases had been ill at home for some time before admission. This fact limits the value of such a pilot study as an indication of the incidence of rickets among the average " well-baby " population for child health purposes. The only way for such a balanced assessment of the frequency in the community is to examine only those children dying immediately after an accident or from an acute fulminating disease. Such limitations, however, would reduce seriously the number of cases available for investigation.

RESULTS

Histologically-proven rickets was noted in 16 of the 98 specimens, including 6 severe, 6 moderate and 4 slight cases. The age distribution of the 98 children and the cases of rickets are listed in Table I.

TABLE I. Age incidence of histological rickets detected at autopsy in 98 consecutive unselected paediatric postmortems (1953-56).

Age	No. of children autopsied	Histological rickets
1 week	3	1
2 weeks	3	2
3 "	3	1
4 "	3	0
2 months	9	3
3 "	8	3
4 "	6	0
5 "	7	0
6 "	4	1
7 "	5	1
8 "	2	0
9 "	5	0
10 "	4	1
11 "	2	0
12 "	3	1
13 "	2	0
14 "	7	1
15 "	4	0
16 "	2	0
18 "	2	0
19 "	2	0
20 "	1	0
21 "	1	1
24 "	7	0

It will be seen, therefore, that 10 of the 16 cases of rickets were noted during the first 3 months of life. 61 of the 98 children were male, as were 11 of the 16 cases of rickets. Of the 98 children, 8 were prematures, and, of these, 6 showed rickets.

The weights of the children were compared with the average weights of normal children of the appropriate sex and age, as given in a standard text (DAVISON, 1946). Infants below 75 per cent. of these standard weights were classified as " undernourished." It is difficult of course to assess undernutrition in infants of low birth-weight during the first few months of life. Furthermore, infants " dead on arrival " were not weighed. Using the above empiric criterion, at least 36 children were undernourished, whereas undernutrition was listed in only 4 of the cases of rickets.

Fourteen children had been hospital in-patients, for a period of at least three weeks before death, and 4 of these infants showed histological proof of rickets. Of 4 other children who had spent a period of hospitalisation previous to their last admission, 2 showed rickets. 4 infants had shown physical signs suggesting clinical rickets, but in no case was the diagnosis confirmed at autopsy. A further case showed clinical, biochemical and radiological evidence of rickets, but there was no histological evidence of the disease. No explanation for this lack of correlation can be offered. Two infants had previously received injections of 300,000 units of vitamin D, and rickets was not present at autopsy. There was no grouping of the cases of rickets in any particular month of the year.

DISCUSSION

The histological evidence of rickets in 16 out of 98 autopsies in children indicated an appreciable incidence of the condition in this region, a fact recognised clinically by local paediatricians. In the U.S.A., FOLLIS et al (1952) have reported an incidence of over 63 per cent. in 1303 autopsies, and quoted SCHMORL's 1909 figure of 94.1 per cent. Compared with such percentages, the incidence in our pilot series is indeed small in relation to that found in the past in temperate climes. Abundant sunshine and the education of mothers on its value, as well as the encouragement of the routine use of oral vitamin D are some of the factors responsible for this relatively low incidence.

Analysis of the details of the 16 infants with rickets reveals that, in 10 of them, there were special factors unrelated to the routine prophylaxis against rickets for the average infant at home. Six were premature infants, four had been hospitalised for an appreciable period and four infants were aged 2, 7, 10 and 25 days respectively. Thus only the remaining 6 children were unexceptional and comparable to the average " well-baby " receiving ordinary care through child-health services. Particular care in providing adequate vitamin D prophylaxis for premature and hospitalised infants is essential even in the subtropics.

The significance of rickets during the first months of life is difficult to assess. PARK (1950) wrote that the condition begins shortly after birth and may therefore appear during the first month of life. FOLLIS (1952) observed only two cases of slight rickets among 360 infants dying within the first two weeks of life, and none among 162 still-born infants. On the other hand, VON SYDOW et al (1956) reported a high incidence of rickets at autopsy of both foetuses and infants, though the percentage was lowest in full-term still-born infants. In our small series, the occurrence of rickets in 4 infants dying within the first 25 days of life is of interest. No deductions on the nutritional status of mothers in this region can be drawn from this finding. VON SYDOW found no correlation between histological evidence of rickets in foetuses and infants and maternal factors, including vitamin D intake and sunlight exposure during pregnancy, biochemical findings and social conditions.

General undernutrition is not commonly associated with rickets. The lack of coexistence of rickets and protein malnutrition (kwashiorkor) has been stressed (WATERLOW, 1955). In our series, undernutrition was present in at least 36 of the 98 children examined. Had less children been undernourished in relation to weight, it is quite likely that the incidence of rickets would have been higher. This factor must be considered when assessing the need for vitamin D prophylaxis in a country with appreciable undernutrition, but apparently with infrequent rickets.

SUMMARY

In 98 consecutive post-mortem examinations of children in Haifa, Israel between 2 days and 2 years of age, histological evidence of rickets was found in 16 cases. Particular etiological factors, including prematurity, an age of less than 25 days and an appreciable period of hospitalisation, were present in 10 of these 16 children. Special attention must be given to the prevention of rickets in premature and hospitalised infants, and such prophylactic measures should not be neglected for the general child population in the subtropics. The influence of undernutrition and the concept of neonatal rickets are briefly mentioned.

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EXCERPTS

GIANT CELL PNEUMONIA OF INFANCY

(Waingwright, J. (1958). *South Afr. J. Lab. Clin. Med.*, 4, 64)

A series of 30 cases of giant cell pneumonia in African children is reported from Durban. The disease, thought to be of viral origin, occurs in the first 4 years of life, presents clinically as a non-specific broncho-pneumonia which fails to respond to antibiotics, and is only diagnosable at autopsy, when large multinucleated giant cells, containing inclusion bodies, are found in the bronchioles and alveoli.

Some International Comparisons of Physical Growth in the Two First Years of Life.

(Falkner, F. et al. (1958). *Courrier*, 8, 1.)

This paper presents preliminary results of a combined study of the growth of children conducted simultaneously in London, Paris, Zurich and Dakar, West Africa. It is of great interest to the tropical pediatrician and should be consulted in the original.

CLINICAL RICKETS IN THE PHILIPPINES

(Report of 22 cases in Manila)

by

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A case of classical rickets seen in Manila was reported recently (STRANSKY and DIZON, 1956). It was stressed, that as noted by others (JELLIFFE, 1955), this condition is now-a-days rare in most temperate regions, but is relatively frequent in some tropical areas. In subsequent correspondence, WALKER et al. (1957) agreed with this observation and emphasized that in South Africa, the disease is primarily related to lack of exposure to sunshine rather than to the dietary.

Since 1956, it has been possible in this short period to collect 22 further cases of rickets, all seem in only one out of the five services in the Department of Pediatrics at the Philippine General Hospital. These children were not admitted with rickets as their main disease, but came in with other complaints and were subsequently found to have rickets.

RESULTS

Table I shows clinical details of these 22 children, including their age, sex, weight, height, circumference of the skull and chest, as well as certain features usually considered to be common stigmata of rickets — namely, craniotabes, caput quadratum, soft borders to the anterior fontanelle, a rickety rosary and enlarged epiphyses (of these features, the first four are those of early disease, while the last is only seen in late rickets and should not be expected in younger children).

The circumferences of both the skull and the chest are disproportionate in active rickets — the skull being relatively larger than the chest. However, it must be noted that in early disease, as well as in healed or healing rickets, this sign is usually absent. Marked impairment of growth occurs in rickets, so that it is important to record the height of the child.

As it was not possible to carry out relevant radiological and biochemical examinations on many children, only clinical aspects will be considered here.

As shown in Table I, the sex distribution was about equal. All children were underweight, with a deficit of about 30 - 40 per cent of the expected normal.

Rickets in Manila usually appears to accompany general malnutrition, and, in this type of case, it is difficult to be sure how much of the growth failure and alterations in the ratio of the circumferences of the head and chest are due to the rickets and how much to general malnutrition. Similarly, both mental retardation and delay in motor functions, such as sitting, standing, and walking, occur in both conditions, and were present in all the present cases without exception.

TABLE I. Clinical details of 22 children with rickets seen in Manila.

Case No.	Age (Ms)	Sex	Main diagnoses	Wt. (kg.)	Ht. (cm.)	Head circ. (cm.)	Chest circ. (cm.)	Signs of rickets				
								CT*	CQ*	SBF*	RR*	EE*
1	9	F	Inf. Diarrhoea	6.0	69	41	43	+	−	−	+	+
2	9	F	Inf. Diarrhoea	5 4	61	42	39	+	+	+	+	+
3	6	F	Inf. Diarrhoea	4.6	64	40	40	+	+	+	+	−
4	8	M	Pulmonary Tuberculosis	4.0	65	41	37	+	−	−	+	−
5	9	F	Broncho pneumonia	6.5	64	41	43	+	+	+	+	−
6	22	F	Malnutrition	7.3	79	48	43	−	−	−	+	−
7	3	M	Infectious Hepatitis	3.6	51	35	37	+	−	+	+	−
8	24	F	Acute Bronchitis	8.0	68	44	44	−	+	−	+	−
9	7	M	Malnutrition	5.0	69	44	46	+	−	−	+	−
10	7	M	Malnutrition	4.8	61	41	39	+	−	−	+	−
11	5	F	Inf. Diarrhoea	4.0	52	39	36	−	+	+	+	−
12	6	M	Inf. Diarrhoea	6.4	68	43	40	+	−	+	+	−
13	4	F	Pulmonary Tuberculosis	3.8	55	35	37	+	+	+	+	−
14	4	M	Inf. Diarrhoea	4.1	57	37	38	−	+	+	+	−
15	4	F	Inf. Diarrhoea	2.3	50	37	36	+	−	+	+	−
16	11	M	Malnutrition	5.9	64	45	42	+	+	+	+	−
17	4	M	Malnutrition	4.6	60	39	38	+	+	+	+	−
18	12	M	Congenital Megacolon	7.0	65	43	40	+	−	−	+	+
19	3	F	Inf. Diarrhoea	3.6	55	35	34	+	−	+	+	−
20	4	M	Broncho pneumonia	8.0	61	42	37	+	+	+	+	−
21	5	M	Anaemia (Aregenerative) Acute Intussusception	4.7	52	38	39	+	−	+	+	+
22	6	F	Pulmonary Tuberculosis	6.0	62	42	37	+	+	+	+	−

* CT = Craniotabes ; CQ = Caput Quadratum ; SBF = Soft-bordered Fontanelle ; RR = Rickety Rosary ; EE = Enlarged Epiphyses.

Children in this series were not observed for a sufficiently long enough time to judge the effect of either vitamin D or dietary therapy, as, owing to the constant pressure of cases seeking admission, patients had to be discharged home after a relatively short time. However, there was the definite impression that cases responded well to vitamin D2 therapy in a relatively short time, so that outpatient follow-ups showed that signs disappeared within a few weeks, if treatment was commenced early enough.

Out of the total 22 cases, craniotabes was present in 18 (82 per cent) soft borders of the anterior fontanelle in 13 (59 per cent) and caput quadratum in 10 (46 per cent) ; while a rickety rosary was noted in all these children. Epiphyseal enlargement is probably a rather late sign, and was, therefore, rather unusual, as rickets in Manila has a tendency to heal as soon as the child is exposed to the sun's rays. In fact, 12 (55 per cent) of the present series were below the age of six months, 17 (77 per cent) were less than 9 months old, and only two cases were over 1 year of age.

It would be interesting to have information concerning the incidence of permanent post-rachitic pelvic deformities capable of interfering with normal delivery in adult women in the lower socio-economic groups in Manila. It is known that this type of deformity develops early in childhood due to muscular traction on the relatively soft bones. Deformities of the thorax, such as can occur in relation to its diaphragmatic insertions (Harrison's sulci), have the same mechanical aetiology, and, as these were present in two of the older children (aged 22 and 24 months respectively), there appears to be a definite possibility that pelvic deformities could also occur.

It may be queried that some of the children with rickety rosary might have been suffering from scurvy. This is not thought to be so, as no cases showed other evidence of clinical scurvy. While the bony cage demonstrated the striking softness of the ribs associated with rickets; in those X-rayed, the radiological changes were those of rickets rather than scurvy. The possibility of coincidental rickets and scurvy also has to be considered, especially as STRANSKY et al. (1951) have shown that Filipino infants from the lower socio-economic groups have a mean blood ascorbic acid level of 0.5 mg./100 ml., as opposed to the value of 1.2 mg./100 ml. quoted for infants in Western countries. However, as noted previously, no child in the present group, even when a rickety rosary was present, showed any manifest clinical evidence of scurvy.

SUMMARY

Rickets is relatively common in Manila. It is usually associated with general malnutrition, although lack of ultra-violet irradiation in slum regions plays a part in its aetiology. The main clinical findings in a series of 22 cases are presented. It is stressed that rickets in a tropical city, such as Manila, is usually relatively mild, having a tendency to spontaneous cure as the child gets more exposures to sunshine. It is suggested that the diagnosis of rickets is often missed, as there is insufficient awareness that the disease can occur in the tropics.

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EXCERPTS

A FOLLOW-UP STUDY OF FIFTEEN CASES OF KWASHIORKOR

(SRIKANTIA, S. G. et al (1958). *Ind. J. Med. Red.*, **46**, 121.)

The results of a follow-up study of 15 previously treated cases of kwashiorkor are presented by workers at Coonoor, South India. The interval between the previous illness and the present investigation varied from 9 months to 8 years. Liver biopsy studies showed no evidence of increased fibrous tissue formation and the liver function tests employed were negative.

PREVALENCE AND GEOGRAPHICAL DISTRIBUTION OF ENDEMIC GOITRE

(KELLY, F. C. and SNEDDEN, W. W. (1958). *Bull WHO*, **18**, 5)

This extremely exhaustive review of the literature fully describes present knowledge concerning the world prevalence of endemic goitre. This, and the other papers in this issue of the bulletin, present the most up-to-date account available of the extent, importance and clinical picture of this condition.

ESCHERICHIA COLI TYPE O111 : B4 AND TYPE O55 : B5 IN DJAKARTA, INDONESIA

(Epidemiological aspects)

by

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In another paper (SAHAB and LIE KIAN JOE, 1958) the occurrence of *E. coli* type 0111 : B4 : H2 and *E. Coli* type 055 : B5 : — was reported in Djakarta.

E. coli type 0111 : B4 : H2 was most frequently found. It is undoubtedly a main factor in the causation of infantile diarrhoea in Djarkarta, while *E. coli* type 055 : B5 : — was detected less frequently.

The present communication deals with certain epidemiological aspects of infantile gastro-enteritis associated with these two types of *E. coli.*

METHODS OF INVESTIGATION AND SOURCE OF MATERIAL

Methods of investigation have already been described in another publication (SAHAB and LIE KIAN JOE, 1958). Usually one faecal specimen from each case was examined. Faeces were often obtained before treatment. However, in a number of cases samples were sent in after antibiotic treatment was instituted. From each Drigalsky plate 4 to 8 suspected *E. coli* colonies were examined. It is obvious that not all positive cases could be detected by this method of investigation. No attempts were made to isolate *E. coli* serotypes from healthy babies.

Epidemiological data were collected from the Newborn Infant Residence and the Pediatric Department of the Central General Hospital in Djakarta.

THE NEWBORN INFANT RESIDENCE

A plan of the Newborn Infant Residence of the Central General Hospital is shown in Fig. 1.

All babies with a body weight of 2000g. or more and born by a normal labour are nursed in ward I. They are usually sent home 3 to 5 days after birth. Room 1 is meant for premature infants above 1500g. They are sent home or transferred to ward I as soon as they weigh 2000g. In room 9 premature infants of less than 1500g. are nursed. They are transferred to room 1 when the body weight is more than 1500g. Room 4 is meant for all premature infants born outside the hospital and having a body weight of less than 2000g. They are also admitted into room 1 or room 9 if room 4 is already full up. All babies born from instrumental labour are nursed in room 2.

Infants who become ill are transferred to the Pediatric Department. If this is not possible, they are isolated in ward II.

The rooms and the wards are usually crowded. In each premature room an average of 6 infants are nursed, with a maximum number of 13. In ward I an average of 30 infants are present, with a maximum number of 50.

The ward and the rooms are provided with facilities for washing and disinfection of the hands. Most of the babies are breast fed, whereas premature infants get artificial feeding or mother's milk from the bottle. The nursing staff consists of a qualified nurse assisted by 8 probationers in the morning hours and by 4 in the afternoon and at night. A physician, who is assigned to the Pediatric Department, visits the building once a day.

Although the Newborn Infant Residence consists of several rooms and 2 wards, from an epidemiological standpoint it is to be considered as one unit, since infants are often moved from one room to another or to the wards. Also, it is evident that nosocomial infections cannot be prevented in the Newborn Infant Residence, mainly because of shortage of nursing personnel and lack of possibilities for effective isolation.

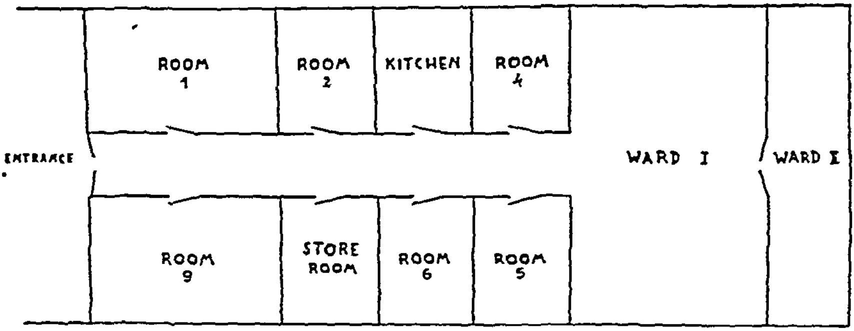

FIG. 1. Plan of the Newborn Infant Residence. Room 1 : Size 5m. x 6m. Premature infants 1500g. — 2000g. Room 2 : Size 3m. x 5m. Babies born from instrumental labour. Room 4 : Size 3m. x 5m. Premature infants born outside. Room 5 : Administration room. Room 6 : Washing room . Room 9 : Size 5m. x 6m. Premature infants below 1500g. Ward I : Size 12m. x 6m. Babies, 2000g. or more. Ward II : Size 12m. x 2½m. Isolation ward.

E. coli TYPE 0111 : B4 : H2 IN THE NEWBORN INFANT RESIDENCE

Incidence. From March 8 to August 1, 1957, 1,141 babies were admitted. In this period 131 cases of gastro-enteritis were examined and from 68 cases *E. coli* type 0111 : B4 ; H2 was isolated. No Shigella or Salmonella organisms were found.

There were 63 cases of diarrhoea from whom no specific agent could be isolated. It is sure that the cause of diarrhoea in a number of infants in this group was also pathogenic *E. coli*.

In this period, 179 infants with a body-weight of 2000g. or less were admitted. Of this group, 10 infants were taken home and 51 died within 5 days of admission. The remaining 118 infants were nursed for more than 5 days in the Newborn Infant Residence. Of this group, 87 infants contracted diarrhoea of whom 48s howed *E. coli* type 0111 : B4 : H2 in the faeces.

There were admitted 962 infants with a body weight of more than 2000g., of whom 562 were sent home and 7 died within 5 days of admission. The remaining 393 infants stayed for more than 5 days in the Newborn Infant Residence. Among this group of infants, 45 contracted diarrhoea ; of whom, 20 showed *E. coli* type 0111 : B4 : H2 in the faeces.

The weight at onset of disease in the 68 cases can be seen in Table I, which shows that the condition is more frequent among prematures.

Sex. *E. coli* type 0111 : B4 : H2 was isolated from 36 male infants and 32 females. The total number of male infants nursed for more than 5 days during the period of study was 270 and that of females was 241.

Incubation period. By incubation period is meant the time which elapses from the day of admission to the appearance of the first symptoms. It was not always easy to determine this period. In acute cases with marked symptoms, the incubation period was easy to fix, but in a number of instances the onset of disease was not clear-cut. In these cases, the first decline of the weight curve was taken as onset of disease. The incubation period of those who were born in the hospital is shown in Table II.

TABLE I. Incidence of disease in neonates of different birth-weights.

Weight in grams	Number of Infants
1000 — 1500	11
1500 — 2000	37
2000 — 2500	11
2500 — 3000	7
3000 — 3500	2
Total	68

TABLE II. Incubation period of disease amongst neonates born in hospital.

Incubation period (in days)	Number of cases
3	4
4	2
5	6
6	5
7	2
8	4
9	—
10	1
11	2
12	1
13	1
Total	28

It is sure that in this group of infants infection occurred in the Newborn Infant Residence. Twelve cases developed symptoms within 5 days after admission.

The incubation period in infants born outside hospital is shown in Table III. These babies were admitted to the Newborn Infant Residence soon after birth, with the exception of 4 who were admitted at the age of 3, 4, 10 and 11 days. Since most of the infants of this group spent a very short time at home, it is likely that most of them contracted the disease in the Newborn Infant Residence. Thirteen of them developed symptoms in 5 days after admission.

One premature infant who was admitted at the age of 14 days, showed diarrhoea on the day of admission. Infection of this case took place at home. This case is not included in Table III.

Monthly distribution of cases. Each month a number of infections occurred (Fig. 2). In March 11 infections took place ; in April 5 ; in May, 16 ; in June, 20 and

TABLE III. Incubation period of disease in infants born outside hospital.

Incubation period (in days)	Number of cases
3	5
4	5
5	3
6	2
7	6
8	3
9	3
10	6
11	1
12	—
13	1
14	—
15	—
16	1
17	—
18	2
19	1
Total	39

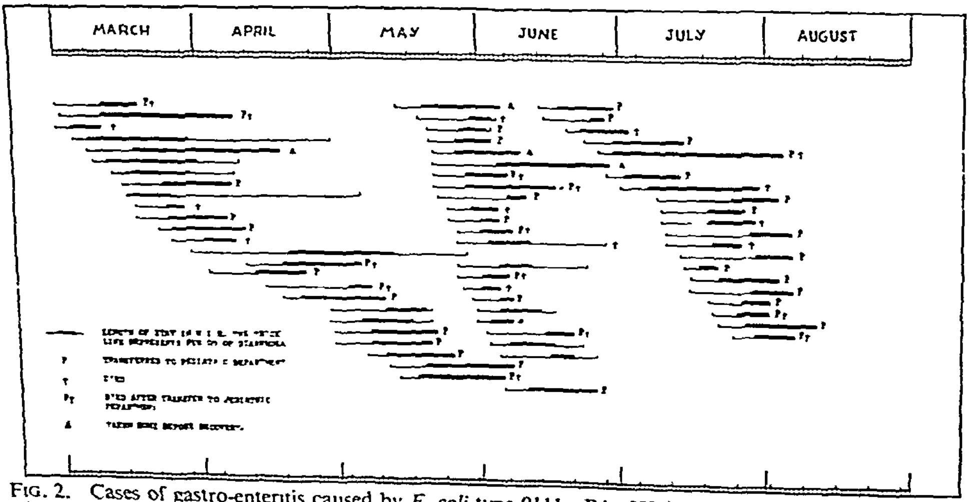

FIG. 2. Cases of gastro-enteritis caused by *E. coli* type 0111 : B4 : H2 in the Newborn Infant Residence of the Central General Hospital in Djakarta observed during the period March 8, 1957 — August 1, 1957.

in July, 15 ; whereas the number of admissions was respectively 221, 239, 266, 201, and 214 infants.

The higher number of infections observed in the last weeks of May and beginning of June was probably due to the presence of an influenza epidemic in Djakarta, resulting in a reduction of nursing personnel. During that period, there were available only one nurse and 6 probationers for the morning hours, and 1 nurse and 3 probationers for the afternoon and night. Moreover, May was a busy month with the highest number of admissions.

Isolation of patients. As soon as cases were diagnosed, they were transferred to the Pediatric Department. However, this was not always possible due to the limited number of isolation rooms. In a number of cases, they had to be nursed in ward II of the Newborn Infant Residence.

Mortality. Out of 68 cases of gastro-enteritis in whom *E. coli* type 0111 : B4 : H2 was found, 24 died. All infants who died weighed less than 2000g. at onset of disease, except one who had a body-weight of 2400g. Thirteen infants died before treatment was instituted and 11 died during or after therapy. No autopsies could be performed, and it was therefore not sure whether gastro-enteritis was the only cause of death.

Five infants were taken home before they had recovered and 4 of these were in a bad condition. The remaining 39 cases recovered completely. Out of 39 cases of diarrhoea from whom no specific *E. coli* was isolated, 12 died.

Strains of E. coli 0111 *isolated.* All strains isolated from the Newborn Infant Residence showed the same serology and biochemical reactions (SAHAB and LIE KIAN JOE, 1958).

Results of sensitivity tests showed that all were resistant to sulphonamides. With the exception of two strains, they showed the same sensitivity pattern towards antibiotics, that is sensitivity to chloramphenicol, oxytetracycline and chlortetracycline, and resistance to penicillin and streptomycin. The two strains showing a deviating sensitivity pattern differed from the others in that they were sensitive to streptomycin, and one of them was also resistant to chlortetracycline and oxytetracycline. Both strains were recovered from infants born in the hospital and represented probably nosocomial infections.

E. coli TYPE 055 : B5 : — IN THE NEWBORN INFANT RESIDENCE

Infections with this type of *E. coli* occurred three times in the Newborn Infant Residence. The first case occurred in room 2 in a fullgrown male baby, born in the hospital on November 13, 1956, with a body-weight of 3,265g. Four days after admission he developed an acute gastro-enteritis with marked symptoms. *E. coli* type 055 : B5 : — was isolated in pure culture. On November 24, 1956 the baby was taken home where he recovered.

The second case occurred in a female premature infant with a body weight of 920g. who was nursed in room 9. She was admitted on September 29, 1956, and developed diarrhoea on November 18, 1956. From the faeces a pure culture of *E. coli* type 055 : B5 : — was obtained. She was transferred to the Pediatric Department and recovered.

The third case occurred in a premature baby who was born outside the hospital and who was admitted into room 4 on November 12, 1956, when the baby was 1 day old.

Body weight was 1,500g. On November 20, 1956 diarrhoea developed and *E. coli* type 055 : B5 : — was isolated. The baby was transferred to the Pediatric Department and died.

All three strains showed the same serology and biochemical reactions (SAHAB and LIE KIAN JOE, 1958).

The three cases occured in November, 1956, and one would assume that they were derived from one source of infection. However, the sensitivity patterns towards sulphonamides and antibiotics were different. The strains isolated from the first two cases were resistant to sulphonamides, chlortetracycline, oxytetracycline and penicillin, and sensitive to chloramphenicol and streptomycin. The third strain was resistant to penicillin and sensitive to sulphonamides, chloramphenicol, chlortetracycline, oxytetracycline and streptomycin.

No further spread of the organisms in the Newborn Infant Residence was observed.

E. coli SEROTYPES IN THE PEDIATRIC DEPARTMENT

Due to the limited number of beds available only severe cases of gastro-enteritis are admitted to the Pediatric Department. They are nursed in the gastro-enteritis section which is planned on an " open-box " system. In each box, 2 to 4 infants are nursed. Cases who are found to harbour specific *E. coli* are transferred to an isolation room.

E. coli serotypes were isolated from cases who were admitted with severe gastro-enteritis and also from cases who came to the hospital with other diseases than gastro-enteritis and who developed diarrhoea during hospitalization. The former group represented infections at home while the latter were probably nosocomial infections. These nosocomial infections occurred in a section with an open box system and neighbouring to the gastro-enteritis section.

A total of 20 cases of *E. coli* type 0111 : B4 : H2 and 2 cases of *E. coli* type 055 : B5 : — were isolated from March 8, 1957, to August 1, 1957. The cases transferred from the Newborn Infant Residence were not included in this material. In one case, a mixed infection of *E. coli* type 0111 : B4 : H2 with *Shigella sonnei* and in another case *E. coli* type 055 : B5 : — with *S. sonnei* were found. There were 14 boys and 8 girls affected. The age varied from 9 days to 3 years. Nineteen children were under the age of 1 year, which shows that young infants are more frequently affected.

In 14 cases of *E. coli* type 0111 : B4 : H2 and in both cases of *E. coli* type 055 : B5 : — infection took place at home. In 4 cases of *E. coli* type 0111 : B4 : H2 infection occurred probably in the Pediatric Department. Three of these children were admitted for bronchopneumonia and the fourth child for megacolon. Diarrhoea developed respectively 7, 13, 13 and 18 days after admission, 2 cases occurring in March 1957 and the other 2 cases in July 1957.

Infection of two other cases of *E. coli* type 0111 : B4 : H2 probably occurred in the Newborn Infant Residence. The first occurred in a baby with a body weight of 2,470g. and born in the hospital. He was nursed for 8 days in the Newborn Infant Residence. One day after discharge from the hospital he developed a severe gastro-enteritis. He was admitted to the Pediatric Department and recovered.

The second case occurred in a female baby with a body weight of 2,650g. who was born in the hospital and who stayed 9 days in the Newborn Infant Residence. Two days after discharge from hospital, she developed diarrhoea. She was admitted to the Pediatric

Department 10 days later and recovered. These two cases were not included in the 68 cases described from the Newborn Infant Residence.

E. coli type 0111 : B4 : H2 was not observed to spread in the gastro-enteritis section of the Pediatric Department, probably because almost all children nursed in this section were given antibiotic treatment.

Seven cases of *E. coli* type 0111 : B4 : H2 and one case of *E. coli* type 055 : B5 : — died. No autopsy could be performed. Most of the fatal cases were complicated with other diseases such as malnutrition and bronchopneumonia.

All strains of *E. coli* type 0111 : B4 showed the same serology and biochemical reactions as those isolated from the Newborn Infant Residence, except one strain which was anaerogenic. This strain occurred in a male boy of 18 days old who was admitted for brocho-pneumonia. Diarrhoea developed 13 days after admission and an anaergogenic *E. coli* type 0111 : B4 : H2 was isolated. Infection occurred probably in the hospital.

The sensitivity pattern of the strains were in general the same as that found for those isolated from the Newborn Infant Residence. They were resistant to sulphonamides, penicillin and streptomycin and sensitive to chloramphenicol, chlortetracycline and oxytetracycline, with the exception of two strains, which were sensitive to streptomycin.

The two strains of *E. coli* type 055 : B5 : — showed the same serology and biochemical reactions as those isolated from the Newborn Infant Residence (SAHAB and LIE KIAN JOE, 1958).

DISCUSSION

E. coli type 0111 : B4 : H2 is an important cause of gastro-enteritis among infants in Djakarta. It is found both in and outside the hospitals.

In the Newborn Infant Residence of the Central General Hospital, gastro-enteritis caused by this serotype of *E. coli* was found endemic, with a high incidence, especially among premature infants. The average number of infants showing diarrhoea and from whom the specific agent was isolated was 3 to 4 per week. Its true incidence must be higher since not all cases could be detected for reasons already mentioned. About 36 per cent. of the proven cases showed disease manifestations in 5 days after admission. With such a great chance of acquiring infection, it is appropriate to assume that a number of those discharged healthy from the ward would develop diarrhoea at home. How large this number is, is difficult to say since no follow-up of many of the discharged infants could be obtained. Two cases of severe gastro-enteritis admitted to the Pediatric Department developed diarrhoea soon after discharge from the Newborn Infant Residence.

It is likely that the disease has been in the Newborn Infant Residence for a long time and that it will remain there, until effective measures are taken to check its further spread. Closing the residence for a certain period is perhaps one of the measures to be taken in order to get rid of the disease. Important factors for maintaining the endemic condition are undoubtedly shortage of nursing personnel and lack of possibilities for effective isolation. Infants born outside the hospital should not be admitted unless there is certainty that they are not excreting pathogenic *E. coli*. A search for healthy carriers among nursing personnel should be made, and the nursing technique should be adequate.

The strains of *E. coli* isolated from the Newborn Infant Residence showed the same serology and biochemical reactions. This does not mean that one strain was responsible for the infections. The different sensitivity patterns towards antibiotics suggest the presence of different strains causing nosocomial infection or outbreaks related to hospitals. Phage typing of the strains would be useful in clarifying this problem.

Nosocomial infections with *E. coli* type 0111 : B4 : H2 were observed twice in March and twice in July 1957 in the Pediatric Department. This is a much lower incidence than that observed in the Newborn Infant Residence, whereas conditions in both buildings are the same. Shortage of nursing personnel and overcrowding are often complained of in the Pediatric Department and pathogenic *E. coli* are constantly being introduced. Yet, nosocomial infections are rare. What factors are responsible for this difference in incidence ? Difference in age of the children might be a factor. Many children admitted to the Pediatric Department are above the age of one year. They are undoubtedly more resistant to pathogenic *E. coli* than newborn infants.

It would be interesting to know the incidence of *E. coli* type 0111 : B4 : H2 outside the hospitals, which might be much higher than that observed in Europe, because of the poor sanitary conditions prevailing in many areas of Djakarta. The number of cases treated in the hospitals does not reflect the true incidence outside the hospital, because only severe cases are hospitalized.

E. coli type 055 : B5 : — was isolated several times in association with gastro-enteritis, when it was isolated in pure culture. The biochemical reactions of this type resemble that of *E. coli* type 055 : B5 : H7 (SAHAB and LIE KIAN JOE, 1958). It is possible that *E. coli* type 055 : B5 : — as found in Djakarta is pathogenic. It was found in the Newborn Infant Residence three times, all occurring as nosocomial infections. However, it did not maintain itself there under conditions which were suitable for *E. coli* type 0111 : B4 : H2 to become endemic.

SUMMARY

E. coli type 0111 : B4 : H2 and type 055 : B5 : — occurred in and outside the hospitals. *E. coli* type 0111 : B4 : H2 was found to be endemic in the Newborn Infant Residence of the Central General Hospital in Djakarta. From March 8, 1957 to August 1, 1957, 131 cases of diarrhoea occurred and, in 68 cases *E. coli* type 0111 : B4 : H2 was isolated. In this period 118 premature infants with a body weight of 2000g. or less were nursed for more than 5 days in the Newborn Infant Residence ; 87 of them contracted diarrhoea and from 48 infants *E. coli type 0111 : B4 : H2* was isolated.

During the same period, there were 393 infants with a body weight of more than 2000g. staying for more than 5 days in the Newborn Infant Residence. Forty-five of this group contracted diarrhoea and 20 of them showed *E. coli* type 0111 : B4 : H2.

Most of the cases represented nosocomial infections. About 36 per cent. of the cases developed disease manifestations in 5 days after admission. Out of 68 cases of diarrhoea from whom *E. coli* type 0111 : B4 8 H2 was isolated, 24 died and, out of 39 cases of diarrhoea from whom no specific agent could be isolated, 12 died. Four cases of nosocomial infections with *E. coli* type 0111 : B4 : H2 were observed in the Pediatric Department of the Central General Hospital in Djakarta.

E. coli type 055 : B5 : — was found *three times* in the Newborn Infant Residence. These probably represented nosocomial infections. This type of *E. coli* could not maintain itself in the Newborn Infant Residence under conditions, which were, however, suitable for *E. coli* type 0111 : B4 : H2 to become endemic.

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THE OCCURRENCE OF *ESCHERICHIA COLI* TYPE 0111 : B4 AND TYPE 055 : B5 IN DJAKARTA, INDONESIA

by

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In recent years much evidence has been found, showing that certain serological types of *Escherichia coli* are the cause of infantile gastro-enteritis. Most of these investigations have been carried out in temperate regions, and little is known about its incidence in tropical countries. LE MINOR (1953) stated that he was unable to find pathogenic *E. coli* in North Africa and Viet Nam, although he had made an intensive search for it. SCHMID (1955), working in Ceylon, found among 1,730 cases of infantile diarrhoea only one harbouring a specific type of *E. coli*. BRAUN (1956) believed that pathogenic *E. coli* would occur mainly in temperate zones and less in tropical countries ; while LUDER (1956), who investigated 100 cases of diarrhoea and vomiting in infants and children in Uganda, East Africa, wrote, that it seemed to him unlikely on clinical grounds that gastro-enteritis as seen in temperate climates occurred to any appreciable extent in that area, whether due to *E. coli* serotypes or to other causes. DARRASSE, DUPIN and CORREA (1954) reported the presence of *E. coli* serotypes in 28 cases of diarrhoea in West Africa.

ISMANGOEN (1957) described an epidemic of diarrhoea among new-born babies in a maternity ward in Central Java. From one case *E. coli* type 0126 and *Salmonella worthinton* were isolated.

The purpose of this communication is to report on the occurrence of *E. coli* type 0111 : B4 and type 055 : B5 in cases of infantile gastro-enteritis in Djakarta and to describe the results of bacteriological and serological studies of the Indonesian *E. coli* strains. The epidemiology of the disease will be published in a separate paper. (LIE KIAN JOE et al, 1958).

SOURCE OF MATERIAL

Faecal specimens were obtained from the following hospitals :

(i) From December 1954 to November 1955, 123 faecal specimens were received from the Pediatric Department of the Military Hospital in Djakarta. They were obtained from cases of gastro-enteritis. Most of the children were not older than 3 years.

(ii) 34 faecal specimens were received from the Pediatric Department of the St. Carolus Hospital. They were obtained from children admitted for gastro-enteritis. Most of the children were not older than 3 years.

(iii) From May 1956 to May 1957, 198 faecal specimens were obtained from the Pediatric Department of the Central General Hospital. They represented cases of gastro-enteritis of different age, although most of them were not older than 3 years.

(iv) From November 1956 to May 1957, faecal specimens were received from the Newborn Infant Residence of the Central General Hospital. They constituted cases of gastro-enteritis among newborn infants.

The faecal specimens were collected in bottles without preservative. It was not always possible to obtain the freshly passed faeces due to technical difficulties. One faecal specimen was usually obtained from each case. From a small number, two or more specimens were examined.

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* We are greatly indebted to Dr. F. KAUFFMANN, of the Statens Seruminstitut in Copenhagen, for providing us with sera and stock cultures of *E. coli*. We wish also to thank Dr. F. ORSKOV for having compared the biochemical reactions of the Djakarta strain with a non-motile strain of *E. coli* 055: B5 isolated in Vienna.

METHODS OF INVESTIGATIONS

KAUFFMANN's methods for isolation and identification of pathogenic *E. coli* were largely used. Isolation of *E. coli* was made on a modified Drigalsky medium, in which meat extract was used instead of placenta extract. The faeces were also streaked on SS agar, desoxycholate citrate agar and Endo agar for isolation of Shigella and Salmonella organisms.

Identification of suspected *E. coli* colonies was done by slide agglutination using bivalent OB serum, containing 0111 B4 and 055 B5 antigen. A positive test was followed by slide agglutination with monovalent sera in the dilution of 1 to 5 and by tube agglutination.

From each Drigalsky agar plate, 4 to 8 yellow *E. coli* colonies were examined.

At the beginning of the work sera obtained from Dr. KAUFFMANN were used. Later we prepared our own sera :

(i) 0111 and 0111 B4 sera were prepared with non motile *E. coli* strain Stoke W (Giles). The O-titers obtained were respectively 2560 and 5120. The B-titer of the OB serum was 640.

(ii) 055 and 055 B5 sera were prepared with non motile *E. coli* strain 972 (Orskov). The O-titers obtained were respectively 5120 and 5120. The B-titer of the OB serum was 1280 - 2560.

(iii) H2 serum was prepared with *E. coli* strain Bi 7455/41 (043 : ? : H2). The H-titer was 40960.

(iv) H12 serum was prepared with *E. coli* strain Bi 316/42 (09 : 9 L : H12). The H-titer was 20480.

(v) H6 serum was prepared with *E. coli* strain A 20a (02 : 1 L : H6). The H-titer was 20480.

RESULTS

The results of faecal examinations are summarised in Table I.

TABLE I. Results of faecal examinations.

	Military Hospital	St. Carolus Hospital	Pediatric Dept. Central General Hospital	Newborn Infant Residence
Number of cases examined	123	34	198	80
S. sonnei	6	—	11	—
S. flexneri	12	1	14	—
Salmonella	—	—	—	—
E. coli 0111 : B4	3	3	17	21
E. coli 055 : B5	—	2	2	3

E. coli type 0111 : B4 were isolated in 44 cases and *E. coli* type 055 : B5 in 7 cases out of a total of 435 cases examined. They were most frequent among newborn infants suffering from diarrhoea. In older infants and children Shigella organisms were most often found. The true incidence of Shigella infections was undoubtedly higher, because there was often much delay in plating out the faecal specimens. In 4 cases, a mixed infection of Shigella and pathogenic coli was found. The absence of Salmonella infections in these children was striking.

Serological and biochemical examination. Study of biochemical reactions showed that all strains examined were typical *Escherichia coli.*

The strains were investigated in detail and careful comparisons of the Djakarta strains with the classical European *E. coli* strains were made using a row of 15 carbohydrates, 3 organic acids and the phenylpropion acid test (D'ALESSANDRO and COMES, 1952).

E. coli 0111 : B4. Fifty-two strains isolated from 44 cases of gastro-enteritis were investigated. All were motile. The biochemical reactions are summarized in Table II. With the exception of strain C888 and strain 123 they showed a homogenous picture of fermentation. *One strain (strain C888)* was anaerogenic.

Tube agglutinations were carried out with all strains, using OB and O sera. All strains behaved the same, except strain 123. Living OK antigens prepared from the Djakarta strains and cultured on glucose agar plates were practically O inagglutinable, whereas they showed typical K agglutination up to the end titer.

The serology of strain 123 which was isolated from the Military Hospital will be discussed later.

H antigens prepared from fully swarmed semi-solid agar cultures gave agglutination to the full titer with H2 serum and none gave agglutination with H12 or H6 serum.

OK sera were prepared from 5 representative strains : one strain isolated from the Military Hospital ; one strain isolated from St. Carolus Hospital showing a negative fermentation of sorbitol ; one strain isolated from the Newborn Infant Residence ; one strain isolated from the Pediatric Department of the Central General Hospital ; strain C888 (anaerogenic), isolated from the Pediatric Department of the Central General Hospital.

The O-titers of the 5 sera were 5120 and the K-titers were 320 - 640.

Absorption tests were carried out with the 5 OK sera using its homologous strains, steamed for 2 hours. Each serum was completely depleted of O as well as K agglutinins, which proved the B nature of the envelope antigens of all strains tested.

Cross absorption tests were carried out using the 5 mentioned Djakarta strains, strain Stoke W and their corresponding sera. Each of the 5 OB sera prepared from Djakarta strains were completely emptied from O as well as B agglutinins after absorption with 2 hours steamed Stoke W culture. OB serum of strain Stoke W was likewise completely exhausted from all agglutinins after absorption with each of the Djakarta strains.

OH serum was prepared from one of the Djakarta strains with a H-titer of more than 40960. Cross absorption test was carried out using the absorbed serum and pure H_2 serum prepared from *E. coli* strain Bi 7455 with corresponding H antigens. In both instances complete disappearance of all H agglutinins was observed.

Two one-sided H absorptions were carried out using the purified Bi 7455 serum. The H antigens were prepared from strain C888 and a strain isolated from the Military Hospital. Also these tests showed that the Djakarta strains possessed H_2 antigen.

Serology of *E. coli* strain 123 : Agglutination of living OK antigen, prepared from this strain, was strongly inhibited in OB serum of *E. coli* strain Stoke W. The steamed OK antigen gave an agglutination to the titer of 1280 only, in OB serum of *E. coli* strain Stoke W and to the full titer in O serum.

Absorption of its OK serum with the homologous culture showed that strain 123 had a K antigen of B nature.

The results of cross absorptions of *E. coli* strain 123, *E. Coli* strain Stoke W and their sera are shown in Table II.

TABLE II. Cross absorptions with Stoke W and 123.

	OB serum Stoke W		OB serum 123	
	unabsorbed	absorbed with 123 *(100°C.)*	unabsorbed	absorbed with *Stoke W (100°C.)*
Stoke W (living)	640	80	320	0
Stoke W (100°C)	5120	640	5120	0
123 (living)	320	0	320	*160*
123 (100°C)	2560	0	5120	*160*

Both sera were not absorbed completely. However, the reduction of the K-titer of the living Stoke W strain in its homologous OB serum after absorption with strain 123 was such that strain 123 may be considered as having B4 antigen or a surface antigen closely identical to B4. Orskov would designate such a strain as 0111+ : B4 (1954).

H antigen of strain 123 gave no agglutination with H2, H6 and H12 serum. Also H antiserum of strain 123 gave no reaction with H antigens of *E. coli* strain Bi 7455/41, Bi 316/42 and A 20a. Its H antigen remains unditified.

Table III summarises the results of biochemical and serological investigations of the 52 strains of *E. coli* type 0111 : B4 isolated in Djakarta as compared with the classical European strains.

E. coli 055 : B5. Seven strains, isolated from seven cases of infantile gastro-enteritis, were investigated. The freshly isolated strains were agglutinated with OB and O serum prepared from the classical *E. coli* strain 972 (ORSKOV, 1954). All strains showed the same agglutination pattern. Agglutination of the living OK antigens showed a partial inhibition (titer 1/320). Steamed OK antigens and steamed broth O antigens were agglutinated to the full titer.

OK serum was prepared from one of the Djakarta strains. Absorption of this serum with its homologous heated culture revealed that the K antigen of the strain was of B type.

Cross absorptions were carried out using the Djakarta strain, *strain 972 and the corresponding sera.* Both sera were completely removed from its O and B agglutinins. One sided absorption tests were carried out with the remaining 6 Djakarta strains using OB serum of strain 972. Each of the strains was found to remove *all O* and *B* agglutinins from the serum. All strains were non motile.

TABLE III. Antigenic structure and fermentation type of Djakarta strains of *E. coli* 0111 : B4 as compared with classical European strains.

	Djakarta strains			European strains			
	50 strains	strain C888	strain 123	Stoke W. (Giles) England	416 (Ten Seldam) Holland	Odense Denmark	F 5737 (Giles) England
antigenic *structure*	0111 : B4 : *H2*	0111 : B4 : H2	0111+ : B4 : ?	0111 : B4 : -	0111 : B4 : H2	0111 : B4 : -	0111 : B4 : H12
adonitol	—	—	—	—	—	—	—
dulcitol	—	—	—	+2 - 3	+2 - 3	+2 - 3	+2 - 3
sorbitol	x	x	+4	+4	+2 - 3	+4	+
arabinose	+	+	+	+	+	+	+
xylose	+	+	+	+	+	+	+
rhamnose	+	+	+	+	+	+	+7
maltose	++	+−	++	++	++	++	+3
salicin	+2 - 4	+2 - 4	—	+	+3 - 5	+2 - 3	+
inositol	—	—	—	—	—	—	—
trehalose	+	+	+	+	+	+	+
sorbose	—	—	—	—	—	—	—
lactose	+	+	+	+	+	+	+
sucrose	+2	+2	—	+	+	+	+
mannitol	++	+−	++	++	++	++	++
glucose	++	+−	++	++	++	++	++
citrate	−14	−14	−14	−14	−14	−14	−14
d-tartrate	x	x	−14	−14	−14	−14	−14
mucate	+2	+2	+2	+	+	+	+
phenylpropion acid	+	+	−4	+	+	+	−4
indole	+	+	+	+	+	—	+
motility	+	+	+	—	+	—	+

Key notes for the fermentation of sugars and alcohols in Tables III and IV.

+	:	positive after one day
—	:	negative after 30 days incubation.
+2	:	positive after 2 days incubation.
+ -	:	fermentation with gas formation.
+ —	:	fermentation without gas formation.
x	:	late or irregularly positive or negative.

In Table IV are summarized the results of biochemical and serological investigations of the Djakarta strains of *E. coli* type O55 : B5 as compared with 2 classical European strains.

TABLE IV. Antigenic structure and fermentation type of Djakarta strains of *E. coli* 055 : B5 as compared with 2 European strains.

	7 Djakarta strains	1064 (Giles) England	972 (Orskov) Denmark
antigenic structure	055 : B : -	055 : B5 : H6	055 : B5 : -
adonitol	x	–	–
dulcitol	+	+2	+3
sorbitol	+	–	–
arabinose	+	+	+
xylose	x	+	+
rhamnose	x	+	+
maltose	++	+10	–
salicin	–	–	–
inositol	–	–	–
trehalose	+	+	+
sorbose	+	+	+
lactose	+	+	+
sucrose	+	+	+
mannitol	++	++	++
glucose	++	++	++
citrate	–14	–14	–14
d-tartrate	–14	–14	–14
mucate	+1 - 2	+	+
phenylpropion acid	–4	–4	–4
indole	+	+	+
motility	–	+	–

DISCUSSION

E. coli serotypes are frequently found in cases of infantile gastro-enteritis in Djakarta, especially in newborn infants. *E. coli* type 0111 : B4 : H2 is most frequent, whereas *E. coli* type 055 : B5 : — is found less often. Studies are under way to determine the presence of other serotypes of *E. coli.*

There has been much written, showing that *E. coli* type 0111 : B4 : H2, isolated in different countries, is pathogenic. There is no doubt that it is also an important factor in the causation of infantile gastro-enteritis in Djakarta.

The Djakarta strains of *E. coli* type 0111 : B4 : H2 differ from the European strains in its fermentation behaviour with dulcitol. The European strains of this serotype all ferment dulcitol slowly (KAUFFMANN and DUPONT, 1950 ; LE MINOR et al, 1954), whereas the Djakarta strains fail to ferment this alcohol.

The Djakarta strains of *E. coli* type 055 : B5 : — differ from the classical serotype 055 : B5 : H6 in its feremtation behaviour towards adonitol, which is not attacked by the majority of *E. coli* strains. The fermentation pattern of the Djakarta strains resemble that of *E. coli* type 055 : B5 : H7, which also show a late or negative fermentation of rhamnose (WRIGHT and VILLANUEVA, 1953). *E. coli* type 055 : B5 : H7 is isolated from cases of infantile enteritis in Vienna (KREPLER and ZISCHKA). It is infrequently found in England (WRIGHT and VILLANUEVA) and France (LE MINOR et al, 1954). *E. coli* type 055 : B5 : H7 is probably pathogenic.

Reports on non-motile *E. coli* 055 : B5 are scarce. It was found twice in Israel (DRIMMER-HERNHEISER and OLITZKI, 1951). The biochemical reactions of the strains were not studied. ORSKOV (personal communication) writes that a non-motile strain of

E. coli 055 : B5 has been isolated by ZISCHKA in Vienna, showing the same biochemical reactions as the Djakarta strains. WRIGHT (1955) found a non-motile *E. coli* 055 : B5 which was dulcitol negative as a cause of an epidemic in Birmingham.

It is possible that the non-motile *E. coli* 055 : B5 isolated in Djakarta is pathogenic. It was found in pure cultures of severe cases of gastro-enteritis.

SUMMARY

E. coli type 0111 : B4 : H2 is an important cause of infantile diarrhoea in Djakarta. The Djakarta strains of *E. coli* 0111 : B4 : H2 differ from the European strains in not-fermenting dulcitol. *E. coli* type 055 : B4 : — has been isolated from 7 cases of infantile gastro-enteritis. The biochemical reactions resemble *E. coli* type 055 : B5 : H7. It is probably pathogenic.

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EXCERPT

INTERNATIONAL JOURNAL OF HEALTH EDUCATION

It has become increasingly realized that the health of people in any part of the world can be improved by a judicious modification of harmful customs by means of health education. This is of especial significance to the MCH worker, whether in the clinic, the hospital or the school health programme.

This new journal is concerned with all aspects of health education, but especially problems found in technically developing regions, as shown by some of the countries covered by papers in the first issue, which include Ecuador, Turkey and Africa.

The journal, which is the official organ of the International Union for Health Education of the Public, will cover a previously neglected field and is therefore a welcome addition. Further information may be obtained from the Editorial office, 3, rue Viollier, Geneva, Switzerland.

SCHOOL HEALTH EDUCATION IN SOUTH EAST ASIA*

Education in almost all of the countries in South East Asia is an extensive undertaking of the governments. Within recent years there has been a great expansion of educational programmes, which has necessitated the building of numerous schools and the recruitment and training of large numbers of teachers.

As a part of general education, health education is influenced by the general status of education — its personnel, facilities and programmes. The general education of teachers, their training in health education, their interest in helping children to attain optimum development instead of providing only the instruction required for school certificates, are among the factors which influence health education.

At the same time that the educational facilities are undergoing rapid expansion, the health services are likewise being developed and extended. Efforts are being made to bring the major communicable diseases under control, to provide maternal and child health services, to promote environmental sanitation in urban and rural areas, and to make medical care available to as many people as practicable.

There is keen awareness of the need to strengthen the health education aspects of school programmes. This concern is expressed in different ways in country reports. It is believed that education about health and nutrition problems should be given priority in countries in which preventable diseases and much malnutrition exist, and where, in general, there is little knowledge of the essential principles of hygiene. This is important for all age groups of the population and especially so for youth in schools.

It is in the context of these large-scale educational and public health undertakings, which are taking place in countries in the Region, that school health education must be considered. The difficulties to be surmounted in evolving sound workable programme in school health education in urban and rural areas in South East Asia must likewise be considered realistically.

This paper includes an amalgamation of the ideas and information contained in reports received from countries in answer to our request. Occasionally certain relevant aspects of these reports have been highlighted.

(1) *The Place of Health Education in General Education*

School health education is concerned with the child's growth and development — physical, emotional, intellectual and social. Ideally, education in health matters should be blended with the total programme of education, being neither neglected nor overemphasized. It is recognized today that the aim of health education is to bring about desirable changes in health knowledge, in attitudes and in practices. It is also recognized that improvements in health habits and attitudes are more likely to be attained through practical experiences centred around day-to-day activities in home, school and community.

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* Working paper prepared for Technical Discussions at the World Health Organisation Regional Committee for S.E. Asia (1956).

Children of school age represent an important and sizeable portion of the population. Although all children of primary school age in countries of the Region are not attending school at present, this situation is changing rapidly. Certainly, this large group of young people, while still growing and developing, is a key part of every community and should receive health teaching adapted to their needs and motives, to the resources in the community, and to their culture.

In primary grades some health teaching can be carried out informally in relation to events as they arise, daily or periodically, such as the morning health inspection or weighing and measuring. Although there should be much flexibility, the teacher even in primary grades should allow time for health activities planned to meet the health needs and interests of children. Emphasis is placed on the formation of desirable health practices.

Health problems which are common to all young children may be largely grouped around : food and water ; sleep and rest ; exercise and play ; elimination ; eyes, ears and teeth ; illness and disease ; accident prevention ; cleanliness, and security. As children grow in age and knowledge, activities are expanded and enlarged accordingly. Sound beginnings in health education can be made during the primary grades, co-ordinating the work in the school with parent activities and community programmes. *There should be a sequence of learning activities in health, as in other areas of learning.*

In the middle and upper grades (secondary schools), health activities can be developed in a more comprehensive way, again taking into consideration pressing health problems, the existing beliefs, the resources, and various cultural factors. At this level it is usually found that organized courses in health and hygiene are necessary, in addition to incidental teaching and the integration of health teaching in other subjects. The interests of youth of these upper age groups are often enlarged in scope to include consideration of major problems in the community, such as tuberculosis and malaria, home and community sanitation, preparation for family living, nutrition, human relations, personal health, and accidents and safety measures. As in the primary grades, the syllabus needs to be worked out in terms of local health problems, prevailing practices and beliefs, the resources available, and the social and cultural patterns. Due consideration should be given to methods of co-ordinating the school programme with parent and community health education.

Almost all countries in South East Asia report that there is some integration of health teaching in various subjects in the curriculum. This is particularly true in home economics courses, in which nutrition, personal hygiene, child care, home nursing, first aid and similar topics are included. In these courses students may have practical experiences in food preparation and related topics. Usually girls take home economics, but in some schools it is reported that boys receive instruction in nutrition, personal health and first aid. Some health items may be included in civics courses. Teachers of physical education who have received training in health education include health teaching in their work in primary and secondary schools. Science teachers have good backgrounds for health teaching and may be in a position to contribute much to health education, especially if health education has been a part of their training.

In every country some teaching in hygiene is going on. However, rather than being reviewed in its broader aspects, well-integrated into the school programme, health education is usually considered as a special subject in the curriculum, largely limited to theoretical instruction in physiology and hygiene. Moreover, in actual practice, in many schools it is a subject that may receive the most cursory attention, with infrequent lectures by teacher *and with little relationship to daily practices.*

The Journal of Tropical Pediatrics, June, 1958

(2) *Elements of a School Health Programme**

The elements which should comprise school health programmes are : (1) the health services, including health appraisal, correction of defects, communicable-disease control, first aid, and activities relating to health supervision and health promotion ; (2) healthful living, including the daily school schedule, school lunches and environmental sanitation ; and (3) health education.

Although school health programmes in the above context are still in their infancy in South East Asia, it is possible to develop some aspects of this programme under almost all circumstances. As health units are organized in urban and rural areas, services can be obtained from local health units. In some places school lunches are considered an important part of the school programme.

Health education is an important part of every phase of the health programme, *and the teacher is the key person in developing health education, keeping close contact with parents and with community health personnel.* It is the alert teacher, too, who can observe the child's deviation from good health and can work through the parents to bring about a correction of any abnormal condition.

Physicians and nurses and other health personnel, such as sanitary inspectors or vaccinators, who may come into contact with children have special contributions to make to health education ; often their influence is far-reaching. All contacts of health workers with school children should be occasions for positive learning. During vaccination or immunization, treatment of illness or health appraisal, health education, favourable or unfavourable takes place. At such times interest is high, and these contacts thus provide " teaching moments." Teaching may be incidental or formal, individualized or in groups.

Schoolchildren and their parents should be prepared by the school for the health services which are available to them. For example, they should learn about the services of the staff at the health centre, about methods of protection against certain diseases, and the values of health supervision. Provision for healthful living during the school day can likewise be the subject of teaching units or for problem-solving activities.

It is important, too, that the teacher's health be considered and protected. The well-being of the teacher involves many other factors, such as satisfaction from work, emotional maturity and adequate training. A mature and happy teacher can contribute much to the good emotional climate of the classroom.

(3) *School Health Education in Relation to Community Health Education*

Health education takes place : (a) in the home ; (b) in the school, and (c) in the community.

At a period in the child's life when fundamental behaviour patterns are being established, it is the parents who are the principal educators and who influence the child's practices such as eating and sleeping, and his emotional reactions to people and situations. The home environment and the relationships of parents to each other and to the children, are the strongest forces in influencing the degree to which children attain mental and social well-being.

Health education of parents and other adults in the family is therefore essential, as is the close co-operation between home and school in all health matters. A parent-education programme should go hand in hand with school health education. If school health education is not related to the home programme and vice-cersa, it cannot be expected to bring about maximum results. This unification of health education in the home and school should also be extended to the community because many health problems are community-wide in scope and require community-wide action. *This concept, however, is not accepted in some countries today.*

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* For definition of " School Health Programme," see Annex 1.

The school programme, too, will become livelier and more practical if pupils make observations on community health problems and, when appropriate, participate in these activities. For example, students, with the help of teachers, may study the methods of malaria control being applied in the local community and may discover ways in which they can co-operate ; or they may learn the methods of fly-control advocated by the health centre and how they can help to eliminate breeding places ; they may observe the construction of a latrine, discuss the need for latrines and determine its cost and methods of upkeep ; they may study the conditions of the school, or investigate the community water supply and how it is safe-guarded from contamination ; they may study the nutritive value of selected foods, and find out how to prepare them in order to conserve food values ; they may contact the agricultural worker to learn how to make a garden.

(4) *Existing Resources for Health Education in Schools*

(i) *Personnel and Training Facilities*

The personnel who have the responsibility for the health education of schoolchildren varies somewhat from country to country in the Region. In most countries, although other departments and agencies may assist, persons from the Department of Education and the Department of Health have major responsibilities. The resources for assisting with school health education programmes in the Region are growing year by year. The following is the situation in individual countries :

(a) *Afghanistan* In Afghanistan there are two medical officers on the staff of the Ministry of Education at Kabul. Beginning a year ago, students at the Teachers' Training Centre at Kabul received instruction in hygiene, environmental sanitation and communicable-disease control within the framework of the community-development orientation course, given through the co-operation of the Ministry of Education, Ministry of Health and international agencies. During the past year, with the help of national and international staff, working conferences were organized for teachers from provincial and rural schools and for directors of education from several provinces.

(b) *Burma.* In Burma, the staff of the Health Education Burea in the Directorate of Health Services, the thirteen assistant health educators in districts and in states, and the health education staff members in the School Health Division in the Directorate, give assistance to schools in accordance with requests.

Teacher-trainees in seven teacher-training institutions, home economics students, mass education organizers and health personnel receive some training in health matters. Refresher courses for teachers are held in Rangoon during the summer months.

(c) *Ceylon* In Ceylon, the persons from the Education Department who contribute to school health education are the physical training instructors in teacher-training colleges, physical education teachers in schools, inspectors of physical education and classroom teachers ; from the Health Department there are medical officers, public-health nurses, public-health inspectors and health educators. Residential courses in health education and physical education are given to trainees in eighteen teacher-training colleges. There are also special periodic in-service training courses, including week-day and Saturday classes in physical education Post-graduate students in the Faculty of Education also receive training in health education

Beginning in 1952, WHO assisted the Government by providing a health educator to the Fundamental Education Project, to integrate training in health education principles and methods as an important part of fundamental education In 1953 a WHO fellowship for a year's study abroad was awarded. A second WHO international fellowship is available in 1956 to a qualified person from the education field to study school health and health education.

(d) *India.* In India, the All-India Institute of Hygiene and Public Health provides courses in health education to all public-health workers studying in the ten-month post-graduate courses and in the various short courses. School health education is given consideration in these courses.

In-service training courses for teachers have been provided in some Indian States, for instance, in the Punjab in 1955 and periodically in the Singur Health Centre area in West Bengal.

Under the WHO/UNICEF assisted Rural Health Nursing Education and Maternal and Child Health Project in the State of Assam, it is expected to provide health education equipment and supplies to ten teacher-training centres as a part of a programme to develop health education in schools. The organization of courses for teachers of health and hygiene and fellowships for training also constitute important aspects of this programme.

(e) *Indonesia.* In Indonesia, a committee consisting of two representatives from the Ministry of Education, two from the Ministry of Health and one from the Ministry of Home Affairs, was formed in 1955 for the purpose of drafting a plan for a national school health programme for the country. A comprehensive scheme is envisaged with reference to : the supervision of school buildings and hygiene of the school periphery ; training in health for schoolchildren and parents ; assistance in accident prevention and illness ; attention to physical and spiritual development ; problems relating to food and nutrition : health appraisal of children and teachers, and immunizations. In this new plan teachers will have an essential role. In order to increase the teacher's skill in teaching about health matters, in counselling students and in working with parents, the committee envisaged that changes would be needed in the present training programme at teachers' institutions, and that efforts should be made to increase the teacher's knowledge on health matters.

(f) *Thailand.* In Thailand, projects in which school health education has been featured and in which WHO has assisted, are the Fundamental Education Centre at Ubol (TUFEC) and the School Health Project at Chachoengsao. During 1954-1956, WHO personnel assisted teachers in selected demonstration school in the Chachoengsao area to develop health activities. Teaching units on child growth and development, nutrition, care of the teeth, safe drinking-water and communicable diseases were prepared, through the active co-operation of the teachers. In the Fundamental Education Centre at Ubol, attention is being given to developing health education with respect to rural areas.

In all countries in which WHO is assisting in health education by providing health educators, these personnel can, in case time permits, help in developing school health education programmes. Likewise, national personnel returning from fellowships which have given them post-graduate training in health education, may be able to assist with such programmes in their respective countries.

(ii) *Physical Facilities*

There are numerous possibilities for improving physical facilities for schools, such as lighting, ventilation and sanitation within the available resources. School facilities should prove to be practical and obtainable in the community.

Although there is general agreement that children should live in a sanitary environment in schools and learn there the correct use of sanitary facilities, environmental sanitation is a serious problem in the schools of South East Asia. Facilities are available in certain types of schools, but are on the whole inadequate. The situation has been made still worse by the fact that there is a large increase in the total school population due to the introduction of free education and the increase of the general population rate in recent years. In several countries, plans have been made and schemes are under way to provide sanitary facilities. An illustration may be found in the description of a rural health unit in Thailand, given in Annex II.

(iii) *Teaching Curriculum and Methods*

It is believed that present methods of instruction in health education in primary, middle and upper schools, need to include more practical training. Although the subject may be in the curriculum, teacher-trainees and teachers-in-service are not taught to carry out the work in a practical and effective way. This is the feeling found in most of the reports from countries, and it indicates a need for building up curricula in health education at all levels, for conducting pilot studies in teacher-training institutions, and for providing training in methods and content of health education for the instructors of health and hygiene in teacher-training institutions.

It has been suggested that the results of studies and surveys of health problems should be utilized in teacher training. For example, teaching can be made effective only when it is based on facts, such as a knowledge of the eating habits of children, of the common diseases from which they suffer, their sanitation practices and sanitary facilities available to them, and their beliefs about health and disease

In some countries, syllabi are now being developed in which attention is given to the many opportunities for health teaching which exist in school life

(iv) *Budget, Organization and Legislation*

For health education no special budget in the schools has been reported. However, departments of health in a number of countries have a special budget for health education.

Little or no reference is made in the country reports to the organization for health education in schools. In Ceylon, in the Department of Education, there are an Assistant Director of Education and, working under him, one senior inspector and three district inspectors and inspectresses, who are directly in charge of physical education and health education in schools. Most of the senior secondary schools have qualified physical education inspectors who do the work, along with trained teachers. Generally speaking, the major emphasis is on physical education, while health education is not often adequately conducted.

No legislation regarding school health education as such is reported from any of the countries in the Region. However, health education may be a compulsory subject in all teacher-training colleges and in the examinations for Teacher's Certificates and the Diploma of Education, as it is in Ceylon.

(v) *Official and Voluntary Agencies*

Among the official agencies which contribute to school health education are the Directorate (or Department) of Education, including the Department of Teacher Training, and the Directorate (or Department) of Health Services. Various other official agencies and departments give assistance, but usually in a smaller way. There is much room for improvement, in many respects, in the working relationships between the Education and Health Departments in carrying out health education work.

Among the many voluntary agencies concerned with health education in schools, are Parent-Teacher Associations, Home Makers' Associations, National Red Cross Societies, National Associations for the Prevention of Tuberculosis, Health and Physical Education Association, and the School Health Education Council.

(vi) *Appraisal*

In school health education, as in other areas of work, there is need for reviewing programmes periodically and making such changes as are necessary to advance local activities in line with modern concepts, as staff and resources become available.

ANNEX I

SUGGESTED DEFINITIONS

" *Health* is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."

Constitution of the World Health Organization.

" *Health education*, like general education, is concerned with change in knowledge, feelings, and behaviour of people."

" The *aim of health education* is to help people to achieve health by their own action and efforts."

Expert Committee on Health Education of the Public, First Session, WHO Techn. Rep. Ser. No. 89.

Health education is often defined as the sum of experiences which favourably influence habits, attitudes and knowledge relating to individual, family and community health.

School health programme may be defined as the school procedures that contribute to the maintenance and improvement of the health of pupils and school personnel, including health services, health education and healthful living.

School health education is that part of health education which takes place in or through the school.

Healthful school living is a " term which designated the provision of a safe and healthful environment, the organization of a healthful school day, and the establishment of inter-personal relationships favourable to the best emotional, social and personal health of pupils."

Health services for school age children include the procedures in or outside the school which are established in an organized way to appraise the health status of pupils and school personnel ; counsel pupils, parents and other persons involved, concerning appraisal findings ; encourage the correction of remediable defects ; help prevent and control disease, and provide emergency care for the sick or injured.

ANNEX II

THE RURAL HEALTH UNIT ASSISTS SCHOOLS IN CHIENGMAI (THAILAND)

In Chiengmai province in Thailand, the Rural Health Unit assisted schools in obtaining sanitary facilities. In selected large schools in various areas, demonstrations of the bare-ground casting of latrine slabs were carried out at the schools with the help of and in the presence of numerous janitors from surrounding schools, together with teachers, local headmen, influential community members, and occasionally the provincial health officer and district administrative officer.

In addition to involving the school personnel in efforts to construct suitable latrines, these demonstrations were aimed toward obtaining the voluntary construction of similar latrines by school staff and citizens. Through the co-operation of the Provincial Department of Education, the sanitation programme was discussed at monthly teachers' meetings. Educators assisted in making a survey of school sanitation needs. The findings of the survey were submitted to the Provincial Education authorities, and, as a result, appreciable funds, based on the designs and estimates which were submitted to provincial authorities, have been set aside to equip schools which require sanitary facilities.

During the survey, the need for more efficient refuse disposal was noted. Although the children collected food debris and general refuse periodically, refuse should not have been thrown on the school grounds in the first place. As a result, two types of depository-cum-disposal units were designed and introduced. In one — a brick or bamboo cylinder, with bamboo ventilators — refuse in suitable proportion with grass and earth, is converted into compost. This is suitable where school gardens exist. As an alternative, incinerators made from empty tar drums were introduced. The Health, Education and Political Departments collaborated in facilitating the adaptation of the incinerators, while the Highway Department supplied the empty drums. Attention is also being given in this programme to the provision of a protected water supply.

Although it was not specified in the report, it is hoped that the schoolchildren not only took part in these demonstrations, but through the teaching programme, understood why the latrines and refuse disposal units were built, how much they cost, and the responsibility of the school for maintaining them. Opportunities like this vitalize health teaching.

The school sanitation programme is part of a broader community scheme which includes the installation of sanitary facilities at all health centres and in district pilot areas. From both a public health and an educational point of view, it is sound planning to give first priority to sanitation in schools, so that children will learn health facts and have the opportunity to develop health practices by first-hand experience as well as through class discussions.

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EDITORIAL

THE PREVENTION OF TETANUS NEONATORUM

Peasant peoples in many parts of the world live in close contact with their domestic animals, and are, therefore, likely to infect wounds, ulcers or abrasions with spores of *Cl. tetani*, an organism found as a commensal in the alimentary canals of cattle, sheep, goats, chickens and other animals, and excreted in their droppings.

While trauma of all kinds is common in tropical childhood, the one inevitable wound experienced by all infants is that produced by the severing of the umbilical cord after birth. The unclean techniques often employed, especially if dirt or dung are used as dressings, mean that tetanus spores are very likely to be introduced into the umbilical stump, which, perhaps because of its dead anaerobic character, seems to form an ideal nidus for infection.

The incidence of neonatal tetanus in different parts of the world is not known accurately, but its commonness in many tropical rural areas seems certain. For example, in the Congo investigators have considered that a high percentage of the neonatal mortality to be due to this disease. There is, however, a considerable need to obtain a clearer statistical view as to how much of a public health problem it is in different regions.

That tetanus neonatorum is *not* a tropical disease in the strictly climatic sense is indicated by the recent historical paper by FERGUSON, in which figures are presented to show that this infection was very prevalent in the Western Isles off the coast of Scotland in the last century. At this time, the disease was well-known there and much feared by mothers, being recognized as "Eight Day Disease." Its etiology appears to have been related, amongst other things, to the probably contaminated earth floors of the crofters' huts and to the fact that cords were often tied with fresh sheeps' wool(1).

Tetanus neonatorum is, theoretically, easily preventable, although, as so often the case, this is more difficult to achieve in practice. Certainly the main preventive measure is simply *not to allow the cord wound* to become contaminated with tetanus spores, and, as most cases occur in rural regions, where child-birth is most usually conducted by indigenous midwives, one practical approach is to try to improve the standards of cleanliness of these untrained and usually elderly women. This has been, and is being, attempted in various parts of the world. Necessary inducements to encourage attendance for training, and, if possible, for subsequent supervision, will have to be developed to suit local circumstances. Probably the outstanding example of lowering of incidence of neonatal tetanus coincident with a simple training scheme for village midwives (*parteras*) is that undertaken in Puerto Rico, whose programme dates back some years.

Another possibility often suggested as a theoretical method is the immunization of women in the last trimester of pregnancy. It is interesting to note that GOMES DE MATTOS and his colleagues at the University of Sao Paolo, Brazil, have shown experimentally that there is a good rise in newborn tetanus antibody titre in the offspring of both women and guinea-pigs immunized late in pregnancy(2).

Whether this would, in fact, be a practicable or necessary public health measure will *depend on various factors, such as the local incidence of the disease, and the expense and* practicality of administering tetanus toxoid to women attending antenatal clinics at MCH centres.

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September, 1958, *The Journal of Tropical Pediatrics*

CALCIUM AND PHOSPHORUS BALANCES IN AFRICAN CHILDREN

(Retention and minimum requirements)

by

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In Africa, as in other underdeveloped parts of the world, large populations are living on very low intakes of calcium and phosphorus without obvious clinical evidence of deficiency. This fact has been interpreted by several authors as indicating an adaptation (Nicholls and Nimalasuriya, 1939 ; McCance and Widdowson, 1955 ; Murthy et al., 1955 ; Walker et al., 1948), but there is little experimental evidence on the subject.

The natives of the Kwango district of the Belgian Congo have very little calcium in their food (Trolli, 1936 ; Lambrechts, Holemans and Rots, 1956) and it seemed worthwhile to study the calcium and phosphorus metabolism, especially in the children of this region, to try to establish the minimum daily requirements. If evidence for adaptation were found, it was hoped to determine something concerning the responsible mechanisms.

METHODS

39 balance studies were conducted on 17 " healthy " African boys of the Basuku tribe, aged approximately 6 to 12 years, and living in a rural area. Each experimental period lasted from 3 to 5 days, with a total of 139 days, during which stools and urine were collected under a close 24-hour supervision. The subjects ranged in weight from 10.6 to 32.2 kg. They ate the usual village diet, with manihot or cassava paste as the staple food, together with dried fish, leafy vegetables, palm oil and groundnuts. In order to obtain higher calcium intakes the cassava flour paste was enriched with powdered milk. Adequate amounts of nitrogen and calories were supplied by this diet. Every day foods, stools and urine were analysed for calcium and phosphorus after having been reduced to a dry ash. The method of Tisdall and Kramer (1921) was employed for calcium and that of Briggs et al. (1922) for phosphorus. The phytate content of the diets was assessed by means of values given by McCance and Widdowson (1935) and expressed as O, + and + +. These symbols represent phytate phosphorus as a percentage of the total phosphorus (+ = 25 to 30 per cent, + + = 50 to 60 per cent).

Results

Calcium balances. The results are recorded in Table I, and are divided into four groups according to the amount of calcium in the diet. Each figure represents the daily average of the 3 to 5 day period for one boy. The results are expressed in mg. per kg. of body weight per 24 hours.

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† Fonds Reine Elisabeth d'Assistance Médicale aux Indigènes du Congo belge.

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TABLE I. Calcium balance studies in "normal" African boys.

No. of test subject	Weight (Kg.)	Intake (mg./kg./24h)	Urine (mg./kg./24h)	Retention (mg./kg./24h)	Apparent* absorption (% intake)	Phytate
(a) Intakes between 6, 9 and 15 mg./kg./24h.						
Ko 1	31.6	9.4	0.7	+1.3	23	0
T 1	26.4	10.7	4.2	−1.2	30	0
Ka 1	27.8	11.0	6.0	−7.5	—	0
S 1	23.0	13.2	3.9	−1.0	—	0
Ko 3	31.3	14.0	4.6	+8.7	20	0
54	21.9	6.9	3.1	−5.8	—	++
53	18.5	9.3	0.3	−2.7	—	++
51	10.6	10.8	0.4	−2.2	—	++
52	13.8	11.2	0.8	−3.4	—	++
69	22.0	11.6	2.5	+4.0	46	++
65	19.7	12.2	0.3	−3.9	—	++
66	22.0	12.9	2.9	0.0	20	++
68	19.7	13.0	1.8	+0 9	19	++
Average	22.1	11.2	2.4	−0.9	—	—
(b) Intakes between 15 and 20 mg./kg./24h.						
K 3	27.8	16.0	4.4	+1.7	34	0
Ko 2	31.3	16.5	3.7	+6.4	72	0
K 2	27.8	18.0	9.5	−2.1	39	0
T 3	26.4	18.3	3.6	−2.4	7	0
S 3	23.0	17.9	2.5	+10.4	73	0
T 2	26.4	20.0	6.4	+8.0	73	0
Kat 1	21.6	17.4	2.6	+7.7	59	+
Muf1	32.2	17.4	3.1	+9.2	71	+
Kak1	28.5	17.8	0.6	+13.0	76	+
Muf2	32.2	19.0	2.0	+11.2	69	+
Kak2	28.5	19.7	1.7	+8.7	53	+
62	21.9	15.5	4.0	+8.3	63	++
61	18.5	15.9	1.1	+4.9	36	++
55	10.6	16.2	0.6	+2.5	19	++
63	10.4	16.8	0.5	+6.9	43	++
Average	24.1	17.5	3.0	+6.6	52.4	—
(c) Intakes between 20 and 30 mg./kg./24 h.						
S 2	23.0	21.7	9.1	+5.0	65	0
Stan1	20.5	21.4	8.1	+8.4	68	+
Kat 2	21.6	25.0	2.3	+17.0	77	+
Stan2	20.5	25.8	2.2	+12.0	55	+
67	10.6	21.1	1.2	+14.4	70	++
59	10.6	22.2	0.9	+7.0	34	++
Average	17.8	22.8	3.9	+10.6	61.5	—
(d) Intakes higher than 50 mg./kg./24h.						
Kwik	22.0	69.0	7.3	30.2	54	0
Mod	23.0	65.3	4.5	32.1	56	0
Mvud	31.0	53.6	3.8	27.0	57	0
Zal	27.0	58.4	0.43	28.1	49	0
Malum	22.0	77.4	4.4	35.0	51	0
Average	25.0	64.7	4.1	30.4	53	—

$$* \text{ Apparent absorption} = \frac{\text{Intake} - \text{faecal excretion}}{\text{Intake}} \times 100$$

Faecal calcium = Intake − (Urinary Calcium + Retained Calcium).

Phosphorus balances. The children have been divided into 5 groups according to the phosphorus intake, and the results given in Table II are the averages for these groups. For the retention of phosphorus, standard deviations have been noted.

TABLE II. Phosphorus balance studies in "normal" African boys

Intake (mg./kg./24h)	Faeces (mg./kg./24h)	Urine (mg./kg./24h)	Retention (mg./kg./24h)	Absorption (% of intake)	Phytate	P. faeces P urine	Ca/P ratio in diet
(a) Intakes between 15 and 20 mg./kg./24h. (6 balances)							
18.5	9.3	12	−2.8 (±4.4)	50	0	0.84	0.76
(b) Intakes between 20 and 25 mg./kg./24h. (8 balances)							
22.5	11.8	9.5	+1 (±6.7)	54.4	0 and +	1.82	0.72
(c) Intakes between 25 and 30 mg./kg./24h. (5 balances)							
27.6	11.2	6.9	9.4 (±4.5)	59.2	+	1.99	0.73
(d) Intaeks between 30 and 40 mg./kg./24h. (10 balances)							
35.7	15.6	6.9	+13.4 (±6.2)	56.2	++	3.41	0.42
(e) Intakes higher than 40 mg./kg./24h. (5 balances with phytic acid)							
49.5	17.8	5.6	26 (±14.5)	62.3	++	3.10	0.35

DISCUSSION

(1) *Apparent absorption.* It will be seen from Tables I and II that the apparent absorption of calcium (intake minus faecal calcium) is higher than the value of 36 per cent found by MACY (1942) or OUTHOUSE and MITCHELL (1939, 1941). Our figures for phosphorus " absorption " are lower in most cases than those of these authors. This may be

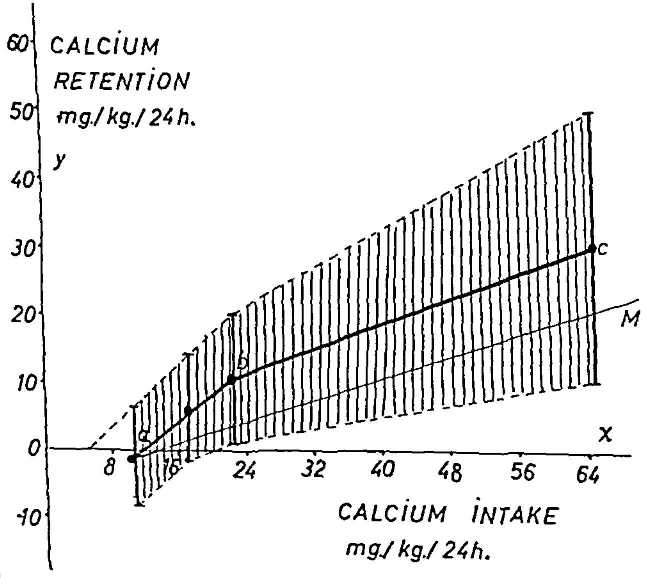

FIG. 1. Calcium intake and retention in African children. (abc= average results. M= average results in Caucasian children (Macy, 1942). The hatched area corresponds to the spread of the individual values for P= 0.05 (+ or − 2 standard deviations).

the consequence of the presence of considerable amounts of phosphorus phytate in our diets and the unfavourable Ca/P ratio.

(2) *Retention.* The retention of phosphorus, like that of calcium on low intakes, is proportional to the intake, as can be seen in Fig. I (line ab) and Fig. 2.

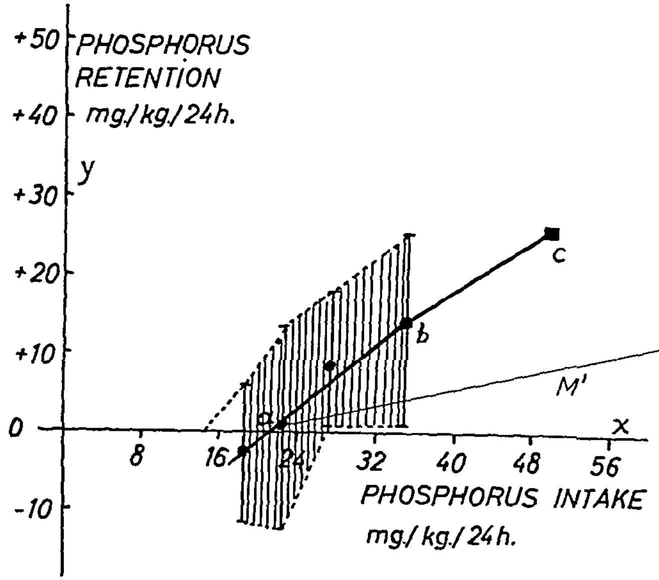

FIG. 2. Phosphorus intake and retention in African children. (abc= average results. M'= average results in Caucasian children (Macy, 1942). The hatched area corresponds to the spread of results for $P=0.05$ (+ or − standard deviations). ■ Average for group (e) with high phyticacid intake. The spread for this group is not represented (standard deviation= 14.5).

The thick line on the figures represents the mean values for the levels of intakes and retentions taken from Tables I and II ; the hatched area corresponds to the spread of the individual values for $P = 0.05$ (mean value ± 2 standard deviations).

The relation between average intakes below 24 mg. of calcium and 35 mg. of phosphorus and corresponding retentions are expressed for both minerals by the function $y = mx - a$, where $a = 20$ for phosphorus and 12 for calcium ; $m = 1$ in both cases. This means that if our African children consume a diet containing less than 24 mg. of calcium/kg./24h., and 35 mg. of phosphorus/kg./24h., they retain 100 per cent. of the fraction of Ca and P above the value a, the maintenance requirement. This conclusion is corroborated by results obtained with radio-active Ca45. (LAMBRECHTS, HOLEMANS, HUBIN, 1958). With increasing intakes, the retention slows down.

For comparison, the average values of calcium and phosphorus retention in childhood published by MACY (1942) have been plotted on the same graphs (lines M and M'). Compared with the retentions given by this author, our subjects show higher average values; it is probable that the difference is not statistically significant for the 50-60 mg. of calcium per kg. level of intake.

(3) *Maintenance requirements.* The maintenance requirements for calcium and phosphorous correspond to the intakes where the balance is in equilibrium. It is clear from Figs. 1 and 2 that this average value (a) is 12 mg. for calcium and 21 mg. for phosphorus. Taking into account the scatter of the individual results, this means that negative balances

are encountered as a rule on intakes below 7 mg./kg./24h. for calcium and 14 mg./kg./24h. for phosphorus. On the other hand positive balances will be observed on intakes higher than 22 mg./kg./24h. and 27 mg./kg./24h. for calcium and phosphorus respectively. Between these two extreme values, a given individual may show a positive, a negative or a zero retention according to his physiological or nutritional status as regards both minerals.

SHERMAN (1920) has established the maintenance requirement for adults as between 5.8 and 11.7 mg./kg./24h., with an average of 6.4 mg. MITCHELL (1956) has stated that " 10 mg./kg./24h. is a normal adult requirement with 15 mg. as an ample allowance." Our results are in keeping with the values mentioned by these authors and with Ca45 balances (LAMBRECHTS, HOLEMANS, HUBIN, 1958).

(4) *Influence of phytic acid on calcium absorption.* The mean values for calcium absorption, in experiments with 0 per cent., 25 per cent. and 50 per cent. of the total phosphorus present as phytic acid in the diet, were 43, 68 and 39 per cent. respectively. On the other hand, the presence or absence in the diet of phytic acid had no influence on the calcium retention (Table III). As shown by Table II (group e) and Fig. 2 the phosphorus retention was not influenced on the average, but the individual results show a wider variation (standard deviation = 14.5).

TABLE III. Influence of phytic acid in the diet on calcium retention.

Absence of phytic acid		Presence of phytic acid	
Intake (mg./kg./24h.)	Retention (mg./kg./24h.)	Intake (mg./kg./24h.)	Retention (mg./kg./24h.)
17.6	+ 4.7	21.8	13.07
13.3	+ 5.4	23.9	10.45
15	− 2.6	18.9	10.57
16.3	+ 1.6	18.3	10.25
Mean 15.5	+ 2.3	20.7	11.00

(5) *Adaptation to low calcium intakes.* Before the balance experiments started, the children lived on the normal village diet providing about 15 mg./kg./24h. of calcium and 20 mg./kg./24h. of phosphorus (LAMBRECHTS, HOLEMANS and ROTS, 1956)—that is to say intakes near the minimum maintenance requirements. The ratio Ca/P in the diet was 0.82 and the proportion of phytic acid was low because the staple foods are cassava flour and green leafy vegetables. The calcium and phosphorus retentions of our subjects were higher than those found by several authors working on Caucasian children. This fact, together with the absence of clinical evidence of mineral deficiencies, might be called "adaptation" to low calcium and phosphorus intakes. In similar conditions of low calcium intakes, NICHOLLS and NIMALASURIYA (1939), WALKER (1951) and MCCANCE and WIDDOWSON (1956) have considered the possibility that adaptation is really an increasing ability to hydrolyse phytic acid and consequently to neutralise the adverse effect of this substance on calcium absorption. Although we made no estimations of phytic acid in the stools, the high faecal phosphorus (Table II) seems to indicate that no complete hydrolysis took place ; while the excellence of the calcium retention is shown by Table III.

In our experimental conditions, a " true adaptation " to low calcium intakes might have been produced by three mechanisms—lowering of the maintenance requirements, more efficient retention, and a combination of both. As we have shown, the maintenance requirements are not different from those found in Caucasian subjects, but the retention on intakes below 24 mg./kg./24 h. is higher than the values given by MACY (1942), as shown in Fig. 1 (line M). Nevertheless, we are inclined to consider that the higher retentions in our subjects are not the expression of an adaptation phenomenon, but merely the consequence of previous calcium (and phosphorus) depletion. MACY has demonstrated the effect of a prefeeding period on a diet rich in calcium, phosphorus and nitrogen on the subsequent retention of these elements.

On the other hand, one of the children in the present study showed the influence of the previous diet on calcium and phosphorus metabolism in African children. This girl, named Kubanda, weighed 16 kg., and had lived for several years on a diet rich in calcium and phosphorus owing to a daily supplement of milk. On an intake of 28 mg./kg./24, she retained 4 mg. of calcium (14 per cent. of the intake) and 1 mg. of phosphorus per kg. of body weight per day. These values correspond approximately to the values given by MACY for white children. This last observation and the previous discussion favour our opinion that the high retentions observed in our experiments are the expression of a mineral depletion of the children of this area and this in spite of the absence of clinical evidence of shortages. As an additional variable factor, it must be borne in mind that people in this rural region have plenty of sunshine and wear only a small amount of clothing. The study of the retention ratios Ca/P and N/P (STEARNS, 1931) in these conditions may give more information on this problem.

CONCLUSIONS

Studies on calcium and phosphorus metabolism of African children usually living on low intakes of these minerals have shown that : (i) the maintenance requirements for these two substances are not lower than those of white children ; (ii) as soon as the intakes exceed the minimum requirement, the retention is high, as well as the "apparent absorption." This is especially true for the low levels of intake which these African children could obtain from their usual village diet. We interpret this retention as the expression of the refilling of the body stores rather than an inherited or acquired adaptation to low intakes. The fact that an African child on a prolonged previous enriched diet behaves like Caucasian children strengthens our opinion. If our interpretation is correct, these results demonstrate the potential existence of calcium and phosphorus deficiencies, without clinical evidence, detectable only by chemical procedures, in populations living on diets low in calcium and phosphorus.

SUMMARY

39 balance experiments (with a total of 139 days) were conducted on 17 " healthy " African boys living in a rural area on diets low in calcium and phosphorus. The average maintenance requirements have been established : 12 mg./kg./24h. (range 17 to 22 mg.) for calcium and 21 mg./kg./24h. for phosphorus (range 14 to 27 mg.) On intakes above this minimum, fairly high retentions of calcium and phosphorus have been observed. The significance of these results is discussed and interpreted as a refilling of body stores rather than an expression of an adaptation.

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EXCERPTS

WHO CONTRIBUTIONS TO CHILD HEALTH

(BIERMAN, J. M. AND ELIOT, M. M. *Publ. Hlth. Reps.*, 1958, 73, 402)

This timely paper is a useful and up-to-date account of the activities of the World Health Organization in the field of maternal and child health during its ten years existence. It describes the initial development of plans, the liaison between WHO and UNICEF, the broad scope of MCH programmes and how attempts are made to match the services to the level of development of the particular country.

CHILD HEALTH AND FEEDING IN TAIWAN (FORMOSA)

(PIRIE, D. *Courrier*, 1958, 8, 129)

The author gives an account of observations made during a two year period in Taiwan while working in a WHO MCH project. The foods used in supplemental feeding of infants are detailed. The incidence of physical signs in Taiwanese children suggestive of protein deficiency is described ; while their growth is compared and contrasted with that of London children.

more efficient retention, and a combination of both. As we have shown, the maintenance requirements are not different from those found in Caucasian subjects, but the retention on intakes below 24 mg./kg./24 h. is higher than the values given by MACY (1942), as shown in Fig. 1 (line M). Nevertheless, we are inclined to consider that the higher retentions in our subjects are not the expression of an adaptation phenomenon, but merely the consequence of previous calcium (and phosphorus) depletion. MACY has demonstrated the effect of a prefeeding period on a diet rich in calcium, phosphorus and nitrogen on the subsequent retention of these elements.

On the other hand, one of the children in the present study showed the influence of the previous diet on calcium and phosphorus metabolism in African children. This girl, named Kubanda, weighed 16 kg., and had lived for several years on a diet rich in calcium and phosphorus owing to a daily supplement of milk. On an intake of 28 mg./kg./24, she retained 4 mg. of calcium (14 per cent. of the intake) and 1 mg. of phosphorus per kg. of body weight per day. These values correspond approximately to the values given by MACY for white children. This last observation and the previous discussion favour our opinion that the high retentions observed in our experiments are the expression of a mineral depletion of the children of this area and this in spite of the absence of clinical evidence of shortages. As an additional variable factor, it must be borne in mind that people in this rural region have plenty of sunshine and wear only a small amount of clothing. The study of the retention ratios Ca/P and N/P (STEARNS, 1931) in these conditions may give more information on this problem.

CONCLUSIONS

Studies on calcium and phosphorus metabolism of African children usually living on low intakes of these minerals have shown that : (i) the maintenance requirements for these two substances are not lower than those of white children ; (ii) as soon as the intakes exceed the minimum requirement, the retention is high, as well as the "apparent absorption." This is especially true for the low levels of intake which these African children could obtain from their usual village diet. We interpret this retention as the expression of the refilling of the body stores rather than an inherited or acquired adaptation to low intakes. The fact that an African child on a prolonged previous enriched diet behaves like Caucasian children strengthens our opinion. If our interpretation is correct, these results demonstrate the potential existence of calcium and phosphorus deficiencies, without clinical evidence, detectable only by chemical procedures, in populations living on diets low in calcium and phosphorus.

SUMMARY

39 balance experiments (with a total of 139 days) were conducted on 17 " healthy " African boys living in a rural area on diets low in calcium and phosphorus. The average maintenance requirements have been established : 12 mg./kg./24h. (range 17 to 22 mg.) for calcium and 21 mg./kg./24h. for phosphorus (range 14 to 27 mg.) On intakes above this minimum, fairly high retentions of calcium and phosphorus have been observed. The significance of these results is discussed and interpreted as a refilling of body stores rather than an expression of an adaptation.

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EXCERPTS

WHO Contributions to Child Health

(Bierman, J. M. and Eliot, M. M. *Publ. Hlth. Reps.*, 1958, 73, 402)

This timely paper is a useful and up-to-date account of the activities of the World Health Organization in the field of maternal and child health during its ten years existence. It describes the initial development of plans, the liaison between WHO and UNICEF, the broad scope of MCH programmes and how attempts are made to match the services to the level of development of the particular country.

Child Health and Feeding in Taiwan (Formosa)

(Pirie, D. *Courrier*, 1958, 8, 129)

The author gives an account of observations made during a two year period in Taiwan while working in a WHO MCH project. The foods used in supplemental feeding of infants are detailed. The incidence of physical signs in Taiwanese children suggestive of protein deficiency is described; while their growth is compared and contrasted with that of London children.

THE EFFECT OF VARIOUS SKIMMED MILK FORMULAE ON THE DIARRHOEA, NITROGEN RETENTION AND INITIATION OF CURE IN KWASHIORKOR*

by

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In the course of the investigations of BROCK, HANSEN, HOWE, PRETORIUS, DAVEL and HENDRICKSE (1955) and of PRETORIUS, HANSEN, DAVEL and BROCK (1956), the impression was gained that, despite the persistence of diarrhoea during treatment, patients suffering from kwashiorkor usually improve rapidly on skimmed milk formulae. TROWELL, DAVIES and DEAN (1954), however, regarded the passage of formed stools as an important sign of successful treatment and for this, as well as for other reasons, added casein to their therapeutic diets. TROWELL et al (1954) cited the work of DRICOT, BEHEYT and CHARLES, who used carob flour for the same purpose. The present investigation was planned with the object of clarifying this question. It was hoped that it would be possible to show, firstly, whether or not the above mentioned supplements have a beneficial effect on the diarrhoea and, secondly, if it is necessary to control the diarrhoea in order to initiate a cure.

It is usually agreed that a high-protein diet should be used in kwashiorkor, and a number of workers (JANSSEN and LE ROUX, 1950 ; ACHAR, 1950 ; TROWELL et al, 1954 ; PRETORIUS et al. 1956) have added supplements to skimmed milk to increase its protein content. For everal years a casein supplement was used in the routine treatment of kwashiorkor at the Pretoria General Hospital, but the work of PRETORIUS et al. (1956) raised doubts as to the need for the supplement. A further object of the present investigation was to throw more light on the latter question, by attempting to show whether or not casein and other supplements do, in fact, assist in the " initiation of a cure."

In the present communication the term " initiation of cure " has been used as defined by BROCK et al. (1955). Briefly, initiation of cure can be said to have taken place when the patient's downhill course has been changed to an upward one. By this time (usually after 12 to 21 days), a rapid rise has taken place in the concentration of albumin in the serum, and the patient has lost his oedema, has become interested in his surroundings, and has regained his appetite.

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MATERIAL AND METHODS

The investigations were carried out during the period from January, 1956, to June, 1957, on eighty Bantu infants with kwashiorkor admitted to the Pretoria General Hospital, all of whom exhibited the signs regarded by BROCK and AUTRET (1952) as characteristic of kwashiorkor.

The patients were divided in a random manner into four groups of twenty subjects. Each group received a different formula. The treatments adopted were as follows :

Dextrimaltose group : Fresh skimmed milk with 5 per cent. dextrimaltose added.

Dried milk group : Spray dried skimmed milk without supplements. This was initially made up in a strength of 1 oz. dried milk to 10 oz. of water but was within a couple of days strengthened to 1½ oz. of dried milk per 10 oz. of water.

Casein group : Fresh skimmed milk with 5 per cent. casein added. The product used, " Casilan " (Glaxo), contained 90 per cent. protein.

Carob flour group : Fresh skimmed milk with 6.5 per cent. carob flour added. The product used was Nestle's " Arobon."

All 4 formulae provided approximately 15 calories per fluid ounce. Two minims of 85 per cent. lactic acid were in all instances added per fluid ounce of formula.

Therapeutic Regimes

For the first 12-18 hours Hartman's solution containing 5 per cent. dextrose was given by mouth to all patients and, in addition, 1-2 gm. of potassium chloride. The milk formulae were then introduced, the fluid intake prescribed being approximately 2½ oz. per lb. of body weight per 24 hours. It was seldom necessary to dilute the mixtures as they were usually well tolerated in full strength. No vitamin supplement was added. In view of the prevalence of infection among the patients, benzathine penicillin G (Bicillin), 1,200,000 U, was injected intramuscularly on admission and sulphadiazine was given orally in a daily dosage of approximately 1½ gm. per lb. bodyweight for 7 days. Broad spectrum antibiotics were prescribed in four instances only, and intravenous therapy with electrolyte solutions and/or plasma and blood was instituted when indicated.

Metabolic Studies

Nitrogen balance studies were performed on an additional 12 male patients. In the first 11 cases (Table II) the studies were commenced on the day following admission. Case 12 was studied a fortnight after admission. In all cases separate collections of urine and faeces were made over a three day period. With the exception of a few minor differences, the technique of HANSEN (1956) was followed. Carmine was used to mark the faeces. None of these 12 patients received broad spectrum antibiotics. Rectal swabs were taken from all 12 cases, but cultures for *Salmonella* and *Shigella* were negative in all instances.

Analytical Methods

Nitrogen in the food, stools and urine was estimated in duplicate by a modification of the macro-Kjeldahl method (LOUW, 1955). Serum proteins were estimated by the method outlined previously (SMIT and PRETORIUS, 1957).

Examination of Stools

All diapers were examined, the character of the stools being recorded by a member of the nursing staff. After examination, the diapers were deposited in a container at the bedside and in the morning, before their removal, inspected by one of the authors. This method, however, has its limitations. It soon became obvious that it is impossible to assess the severity of diarrhoea by simple inspection of diapers, because watery stools are soaked into the diapers, leaving only a small residue of faecal matter.

The number of diapers soiled daily by each group was also noted. This information also is only of limited value, since for the purpose of statistical analysis, a diaper containing a small stool is regarded as of the same significance as one containing a large stool. Although the nursing staff were instructed to inspect the patients frequently, it is not unlikely that in some instances more than one stool was passed in the same diaper. In spite of these limitations, however, it was possible to form a fair impression as to the effectiveness of the different formulae to control diarrhoea.

RESULTS

The therapeutic effects of the four formulae were assessed with respect to their ability to " initiate cure," to control diarrhoea, to elevate the serum albumin concentration and to promote absorption and retention of nitrogen. The results for initiation of cure are shown in Table I, for the nitrogen balances in Table II and Fig. IV, for the consistency and number of the stools in Figs. 1 and 2, and for the changes in serum albumin concentration in Fig. 3.

Influence of the diets on initiation of cure

The results have been arranged in Table I.

TABLE I. Summary of Clinical results.

Diet	No. of cases	Group I	Group II	Group III (Deaths)	
				Total	48 hour deaths excluded
Dried Skimmed Milk	20	16	2	2	1
Skimmed Milk + Dextrimaltose	20	14	5	1	0
Skimmed Milk + casein	20	12	1	7	3
Skimmed Milk + carob flour	20	15	3	2	2

Group I includes all cases where dietary treatment was successful and in which a cure was fully initiated within 21 days.

Group II includes all the cases in which supportive transfusion of plasma and blood was necessary to initiate a cure,

Group III includes all deaths, including those which occurred within 48 hours.

For the purpose of statistical analysis, the simplified form of grouping used previously (BROCK et al., 1955 ; PRETORIUS et al., 1956) has been adopted. All cases not classed as a Group I cure have been regarded as failures. The results analysed by means of the Chi-square test, revealed no significant difference in cure rate between the four therapeutic groups.

TABLE II. Nitrogen balance results.

Case	Diet	Weight (kg.)	Calories kg/day	Nitrogen mg/kg/day	Urinary excretion of mg/kg/day	Faecal excretion of Nitrogen mg/kg/day	Total Nitrogen excreation mg/kg/day	Nitrogen retention mg/kg/day	% Nitrogen retention	% Nitrogen absorption
1	Dried skimmed milk	10.3	44	658	187	116	301	357	54	83
2	,, ,, ,,	8.6	52	797	207	108	315	482	61	87
3	,, ,, ,,	8.0	32	490	92	132	224	266	54	73
4	Skimmed milk + 5% dextrimaltose	8.3	72	576	143	127	270	306	53	78
5	,,	6.4	77	751	93	145	238	513	68	81
6	,,	9.3	73	702	168	131	299	403	57	82
7	Skimmed milk + 5% casein	8.6	75	1,640	601	170	771	869	53	90
8	,,	7.5	42	951	130	198	328	623	66	79
9	,,	7.1	65	1,386	402	172	574	812	59	88
10	Skimmed milk + 5% carob flour	5.8	36	379	125	170	295	84	22	55
11	,,	7.8	68	727	175	313	488	239	33	57
12	,,	8.2	84	883	509	312	821	62	7	65

Influence on the character and number of the stools

In the 12-18 hour period following admission and before dietary therapy was instituted, 41 patients out of 75 (55 per cent.) passed loose or watery stools, whereas 34 (45 per cent.) either passed formed stools or else no stools at all. In the latter group of 34 cases, however, 32 developed loose or watery stools within a day or two of the institution of dietary treatment.

The effects of the four formulae on the consistency of the stools, are indicated in Fig. 1. The highest percentage of formed or pasty stools was found in the casein group. The carob flour group had the next highest percentage. This effect, however, was not produced rapidly, was in no way dramatic and was not at all essential for the initiation of cure.

During the first 12 to 18 hours after admission, the average number of stools passed by each patient was small (average 1.8 ; range 0-7). A notable increase occurred, however, as soon as the skimmed milk feeds were introduced ; this occurred in all four therapeutic groups (Fig. 2).

The relative effectiveness of the four formulae in reducing the number of stools passed per day was analysed by means of the Student's t-test at a probability margin of 5 per cent. During the first week of treatment (first 2 days excluded) the carob flour groups passed a significantly smaller number of stools than did the dextrimaltose group (Fig. 2).

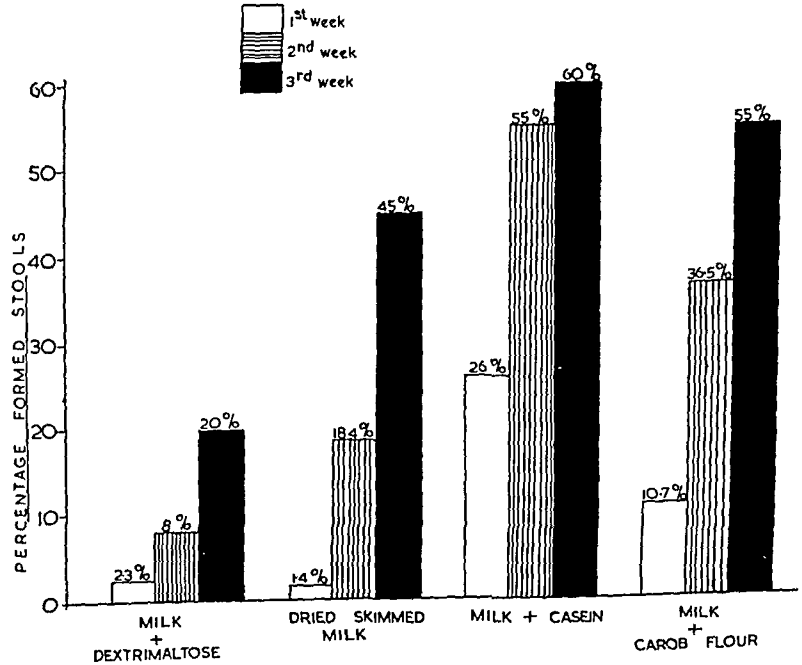

FIG. 1. Percentage of formed stools among the total number of stools passed in the 1st, 2nd and 3rd weeks by the four therapeutic groups.

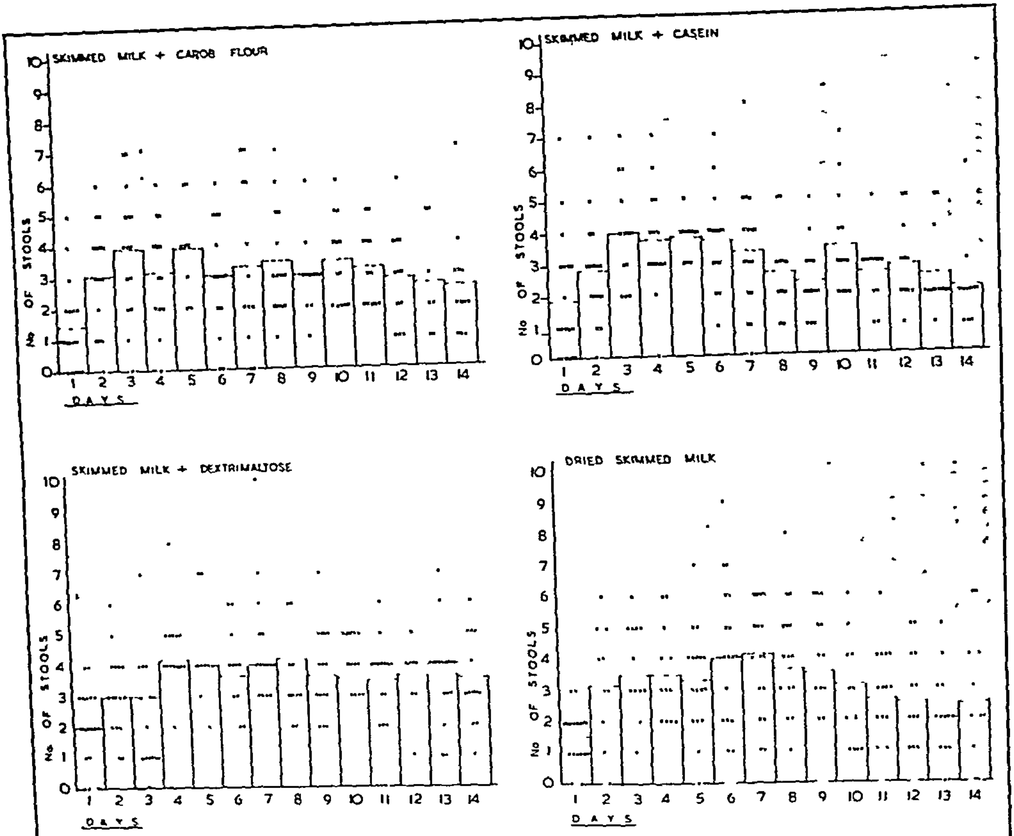

FIG. 2. Number of stools passed in the first two weeks of treatment by the patients of the four therapeutic groups. Height of columns represents the average number stools passed per day.

In the 2nd week there were no significant differences between the average number of stools passed daily by the casein, carob flour and dried milk groups, but all three groups passed a significantly smaller number than did the dextrimaltose group. There was no significant difference between the average number of stools passed by the dextrimaltose group in the 1st and 2nd weeks, but the other three groups passed a significantly smaller number of stools in the second week than in the first week.

The effect of serum albumin concentrations

In Fig. 3 are shown the regression curves for rise of serum albumin concentration in each group. Except in the 4th week the values tended to be higher for the casein group than for the other three groups. An analysis of variance and the application of the " F-test " reveal, however, that the difference is significant during the 3rd week only.

Effects on nitrogen absorption and retention

The results, which are shown in Table II, show that in spite of some impairment in the absorption of nitrogen, the amounts retained were high in the majority of cases. The casein group had the highest intake of nitrogen, and the net amounts absorbed and retained were higher in this group than in any other groups (Fig. 4).

The impairment in the absorption of nitrogen was greatest in the carob flour group. Patient No. 10 (Table II), who absorbed only 55 per cent. of his nitrogen intake, and retained 84 mg./kg/day, had severe diarrhoea which was not controlled by the added carob flour in his diet. Case No. 11, who initially had no diarrhoea, soon developed loose stools after the commencement of the balance study and absorbed only 57 per cent. of his nitrogen intake. Another patient in this group (case No. 12) who was studied a fortnight after admission and who passed formed stools during the balance period, also showed gross impairment in his absorption of nitrogen.

DISCUSSION

Diarrhoea commonly occurs in patients suffering from kwashiorkor. It is present in the vast majority of cases in South Africa (GILLMAN and GILLMAN, 1951 ; SUCKLING and CAMPBELL, 1956 ; HANSEN, 1957) and its occurrence has also been described in other countries (SANTOS, 1955 ; STUART, 1955 ; GOPALAN, 1955). The cause of the diarrhoea

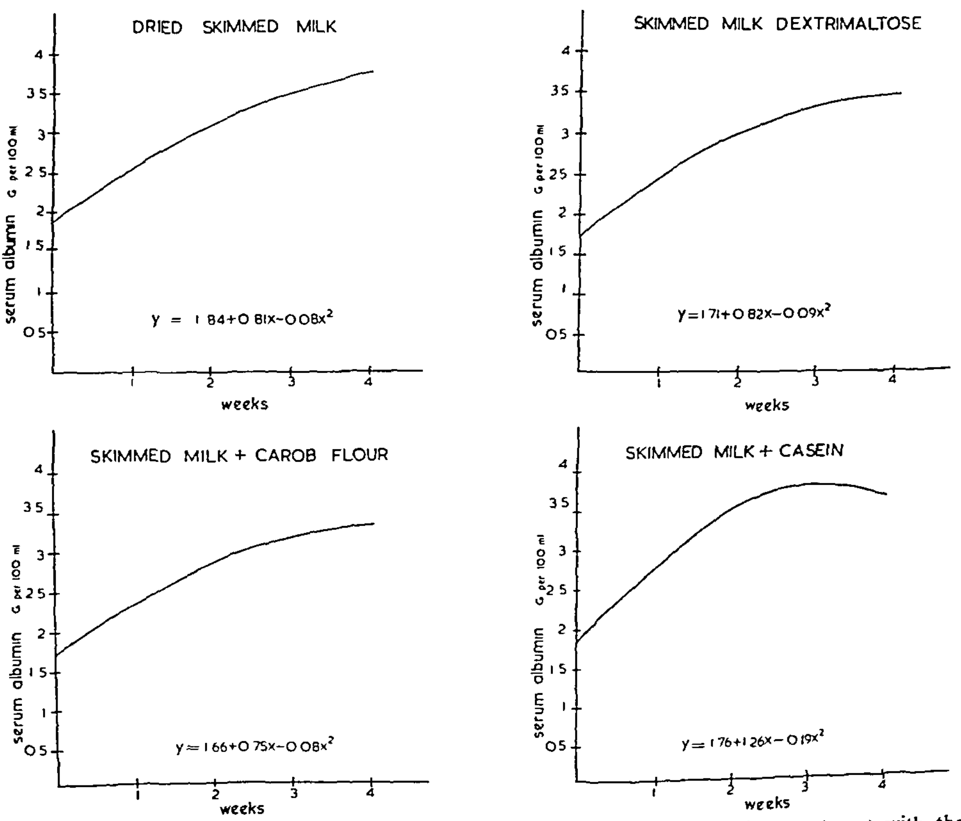

FIG. 3. Regression curves of rise of serum albumin (Y) against time (X) during treatment with the four formulae.

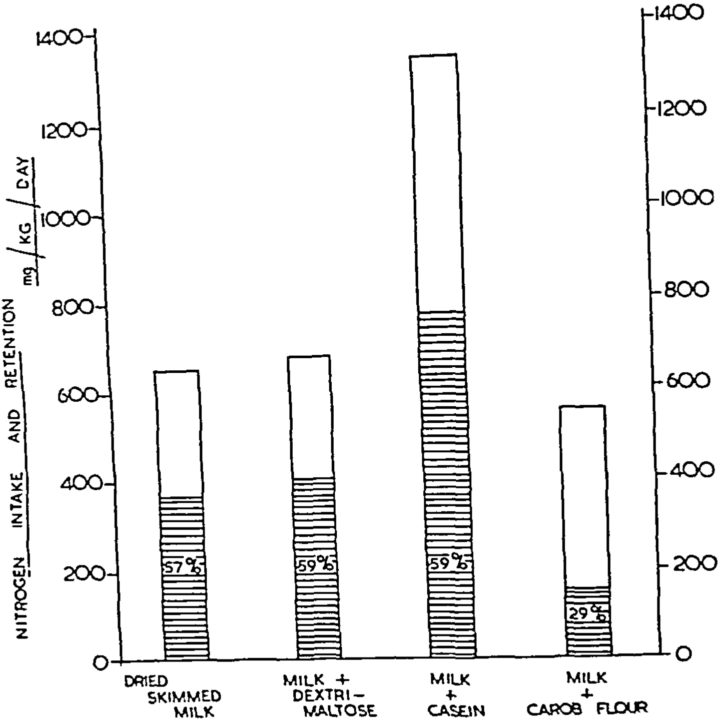

FIG. 4. Intake and retention of nitrogen on the four formulae. Height of column represents intake and hatched area retention. The values are taken from Table II. Case No. 12 is excluded.

is still uncertain. GOPALAN (1955), observed that, at Coonoor in India, the peak incidence of kwashiorkor followed about 1 to 2 months after the fly and infective diarrhoea season. In Pretoria (COETZEE and PRETORIUS, 1956), the frequency with which *Salmonella*, *Shigella* and various strains of "pathogenic" *E. coli* were cultured from rectal swabs taken from kwashiorkor cases, was not significantly different from the corresponding frequency observed among controls without diarrhoea. THOMPSON and TROWELL (1952) showed that a diminished secretion of digestive enzymes occurred in kwashiorkor, possibly a cause of diarrhoea (TROWELL et al., 1954).

In the present series, 55 per cent. of the patients passed loose or watery stools in the 12 to 18 hour period preceding the commencement of dietary treatment, but the average number of diapers soiled per patient was less than two. During this period, however, the patients received no food or fluids other than an electrolyte-dextrose solution, which may have diminished the diarrhoea. Furthermore, the majority of cases suffered from anorexia, so that the intake of food in the period immediately preceding admission was probably very low. It was very striking that 32 out of 34 cases who initially passed formed stools or no stools at all, developed loose stools soon after the commencement of treatment with the various skimmed milk formulae. This finding corresponds with the experience of TROWELL et al. (1954), who attributed the diarrhoea to the lactose in skimmed milk. It may be of some significance that, in the present series, more frequent and looser stools were produced by the patients in the dextrimaltose group than by those in the other groups. The patients in the dextrimaltose group received 60 to 75 gm. of dextrimaltose daily. In addition, they received from about 50 to 72 gm. of lactose daily in the skimmed milk, so that their total intake of carbohydrate was high. While the addition of dextrimaltose to skimmed milk appeared to have a distinct diarrhoea promoting effect on the patients, the addition of casein or carob flour appeared to favour the passage of formed stools (Fig. 1). The latter effect, however, did not take place rapidly, and even in the 3rd week the proportion of formed stools passed by the patients in the casein group was only 60 per cent. In this respect our cases differed from those of TROWELL et al. (1954), who found that the addition of casein usually resulted in the passage of formed stools within two days. It was also noticeable in the present experiment that supplements of casein or carob flour did not prevent the increase in the number and looseness of the stools which usually occurs after the introduction of skimmed milk formulae. This is well illustrated by cases No. 8 and 11 who received casein and carob flour supplements respectively, and on whom balance studies were performed (Table II). Initially both patients passed formed stools, but the stools became very loose on the 2nd day of the balance period.

Despite the difficulties mentioned previously in accurately assessing the exact volume of the stools when inspected on a diaper, a good impression could be gained as to the presence or absence of diarrhoea. This impression was confirmed in the present balance studies, where accurate collections were made. Unfortunately, however, stools were not weighed and the collecting jars were rinsed with distilled water, so that the exact volumes are not known.

Since the majority of the patients improved rapidly, regardless of the consistency of the stools, the passage of formed stools could not be considered as an important sign of successful treatment. The initiation of cure was effected equally well in all 4 groups (Table I), and the addition of casein or carob flour did not result in a higher rate of cure. GYÖRGY (1955) considered that it may be dangerous to feed high protein diets to children suffering from protein malnutrition, since they may suddenly collapse and die. Although the total number of deaths was largest in the casein group, the group with the highest intake of protein, no conclusion can be drawn because in this series death took place only among cases who were very severely affected and who, with two exceptions, showed obvious signs of infection.

Although the serum albumin concentrations tended to be slightly higher in the casein group than in the other groups, the differences was significant during the 3rd week only (Fig. 3) ; and although the serum albumin levels for the carob flour tended to be the lowest, the differences between this group and the dextrimaltose and dried milk groups were not significant. It seems reasonable to conclude that the rise in the serum albumin concentration was satisfactory in all four groups.

As can be seen from Table II, some degree of impairment in the absorption of nitrogen was apparent in most cases, a finding which confirms the earlier observations of HOLEMANS and LAMBRECHTS (1955) and HANSEN 1956). Except in the case of the carob flour group, there was a general tendency for the total amounts of nitrogen absorbed and retained to increase in proportion with the amounts fed, as was also the experience of HOLEMANS and LAMBRECHTS (1955). It was noticeable that the impairment in nitrogen absorption was greatest in the carob flour group. Case No. 10 (Table II) absorbed only 55 per cent of his nitrogen intake, but it should be noted that this patient had severe diarrhoea, which was not controlled by the carob flour, and the lowest intake of nitrogen. The intake of nitrogen by case No. 11 (Table II) was comparable with the intakes in the dextrimaltose and dried milk groups, though lower than that in the casein group, yet the faecal loss of nitrogen was greater than in any of the other groups. This patient initially passed formed stools which became loose on the second day of the balance period. Patient No. 12, on whom a balance study was performed a fortnight after admission, showed gross impairment in his absorption of nitrogen, although the poor nitrogen retention is due more to loss in the urine than in the stools, a finding we cannot explain. Although the number of balance studies performed is small, it appears that the added carob flour may have interfered with the absorption of protein. This possibility is being further investigated at present and will be reported separately. Clinically, no adverse effects of carob flour were detected. It is conceivable, however, that if intake of protein is marginal, this impairment of absorption may lead to inadequate retention of nitrogen.

The highest percentage absorption of nitrogen was found in the casein group where the intake of protein was highest (Table II and Fig. 4) ; but although the total amount of nitrogen retained by the patients in the casein group were very high, the percentage retentions were not appreciably higher than in the dried skimmed milk or dextrimaltose group.

It has been shown (HOLT, 1956) that in acute diarrhoea and some other conditions associated with intestinal intolerance, net absorption of nitrogen increased with the intake despite additional faecal losses. The same finding applies to kwashiorkor but it seems doubtful whether the addition of protein supplements to skimmed milk is really necessary, as retentions of about 250 to 500 mg. nitrogen per kg. of body weight per day were obtained with skimmed milk alone.

The minimum, and optimum, amounts of protein required daily to cure kwashiorkor are unknown. DEAN (1954) regarded 50 gm. as the minimum amount. In the present investigation the daily amounts of protein prescribed for the patients in the destrimaltose and carob flour groups, where the nitrogen intakes were the lowest, ranged from 30 to 50 gm. (average about 5.7 g./kg.) over a period of 4 weeks. These amounts were adequate to initiate cure, to raise the serum albumin level rapidly and to increase weight. By converting the nitrogen values shown in Table II into protein, it can be seen that the amounts of protein retained by some of the patients who took part in the metabolic studies were high even on some of the lower intakes of protein, and even in the presence of diarrhoea with its attendant impairment of absorption. It is clear, however, as was also pointed out by others (HOLEMAN and LAMBRECHTS, 1955 ; HANSEN, 1956 ; ROBINSON et al., 1957), that if marginal quantities of protein are fed in the presence of severe diarrhoea, inadequate absorption may result. This appears to be especially liable to occur if carob flour is added to skimmed milk in an attempt to control diarrhoea.

SUMMARY

Eighty Bantu infants admitted to hospital with kwashiorkor were divided at random into four equal groups. The patients in three of these groups were treated with fresh skimmed milk together with a supplement, which consisted of dextrimaltose in the case of one group, of casein in that of another group, and of carob flour in the case of the third group. The patients in the fourth group were given a formula containing spray dried skimmed milk, with no supplement.

It was found that " initiation of cure " was effected equally well in all four groups, and that the serum albumin concentrations rose satisfactorily in all groups. The proportion of formed or pasty stools passed was higher among patients receiving casein or carob flour than among those in the other two groups. However, since the majority of

the patients improved rapidly, regardless of the consistency of the stools, the passage of formed stools could not be considered as an important sign of successful treatment.

Nitrogen balance studies were carried out on an additional twelve patients receiving the same diets. The results showed that the three patients who received the casein supplement, and who had the highest intakes of protein, retained more nitrogen per kg. of body weight per day than did the patients in the other groups. Nevertheless, the net amounts retained by the patients who received the dextrimaltose supplement, or skimmed milk alone, were so high that it seems doubtful whether the addition of protein supplements to skimmed milk is necessary. It was noticeable that the impairment in nitrogen absorption, which occurred in the majority of patients studied, was greatest in the carob flour group. Except in the case of the latter group, there was a general tendency for the net amounts of nitrogen absorbed and retained to increase proportionally with the amounts fed.

It is concluded that the addition of expensive supplements to skimmed milk with the object of raising the protein intakes of patients or of promoting the passage of formed stools, was not essential for the initiation of cure in kwashiorkor.

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SURGICAL ASCARIASIS IN CHILDREN

(A REVIEW OF 50 CASES)

by

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Ascariasis is probably the commonest helminthic infection in man, yet rarely are dangers of such infections emphasized. Most of the literature deals with the non-surgical manifestations. One of the earliest reports of intestinal obstruction due to ascariasis was by Taylor (1899). The earliest reported from Ceylon was by Alles (1924), who described a woman of twenty-four years with obstruction due to roundworms, relieved by enterotomy and the removal of 547 worms.

A survey in the Children's Hospital, Colombo, from 1950 to 1953 showed that at least 37.1 per cent. of the children were infested with the *Ascaris lumbricoides*, either singly or in association with other parasites (C. C. de Silva, 1957). The incidence of ascariasis occurred most frequently between the ages of 1 to 6 years and especially between 2 to 4 years. Of the fifty cases reviewed here, 44 children were between 1½ to 4 years. The youngest child was ten months and the oldest ten years.

Ascariasis was found to be as common in children from the town as in the villages of Ceylon (C. C. de Silva, 1957), and in the poorer classes the infestation was often massive, some of the children passing as many as 500 to 700 worms after treatment. Nearly 50 per cent. had mixed infestations with the *Necator americanus* and/or the *Trichuris trichuria.*

This review is based on 50 cases of intestinal obstruction due to roundworms, that required laparotomy, seen at the Children's Hospital, Colombo during the last two years (Table I).

Since ascariasis in general is commoner in children, a higher incidence of surgical complications may be expected in them ; but these same disorders are occasionally encountered in adults and even in elderly patients.

OBSTRUCTION DUE TO THE ASCARIS

Obstruction was by far the commonest surgical complication of ascariasis. The condition usually commenced with vomiting, often after a vermifuge. In the 50 cases reviewed, 28 had been given a vermifuge a few days prior to admission. Most of the complications were in those children that had been given santonin. Associated with the vomiting, there was colicky abdominal pain, mild at the onset, but gradually increasing

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in severity and localised to the umbilicus. The child often, but not always, vomited roundworms and had constipation. In the more advanced cases there was abdominal distension with visible peristalsis. An ill-defined sausage-shaped mass lying traversely across the lower abdomen, more often to the right than to the left, was found. If the child was ill-nourished, as the majority of these patients were, and the abdominal wall thin, the worms could often be palpated with the flat of one's hand. Rectal examination also revealed the lump and sometimes the worms were felt in the mass. The rectum was often empty, and, rarely, blood stained mucus was present.

CAUSE OF THE OBSTRUCTION

That obstruction is at least partly mechanical is shown by the disposition of the worms longitudinally along the length of the bowel twisted very much in the fashion of ropes. The worms may partially or completely obstruct the lumen of the bowel. The number of worms may vary from a few to several hundreds, occupying several feet of the bowel. In two of the cases under review they were so tightly packed that the blood supply to the bowel had been affected, causing gangrene and necessitating a resection (Fig. I). The worms are often tightly twisted on themselves and at operation the whole mass of worms may be propelled onwards along the gut like a sausage or foreign body inside the bowel ; but if there is marked spasm of the bowel, this will be difficult.

TABLE I. Analysis of the 50 cases reviewed (June, 1954-July, 1956).

Intestinal obstruction	No. of Cases	No. of Deaths
A lump in the abdomen — worms milked into caecum	13	1
Enterotomy with removal of worms	4	1
Resection of the obstructed loop	2	2
Volvulus	3	3
Intussusception	4	1
Perforations		
Tip of appendix, rest normal	6	4
Base of appendix, rest normal	5	4
Jejunum	2	2
Ileum	5	3
No perforation detected	4	2
Meckel's diverticulum with perforation	2	—
Total	24	15
Grand total of perforations and obstructions	50	23

The obstruction may be due partly to the spasm of the intestinal muscle caused by the irritation and reaction of the chitin from the outer covering of the worm's body on the intestinal mucosa of the host. The introduction of an irritant into a vessel containing a worm causes it readily to secrete a slimy fluid. Similarly a purgative or vermifuge may cause the worms to secrete a toxic fluid which may initiate the spasm. Often the obstruction at operation is found at the terminal end of the ileum suggesting that spasm of the ileocaecal valve too may be a contributory factor. The worms usually live in the upper part of the small intestine which is their natural habitat, but owing to increased peristalsis the bolus of worms is pushed onwards till it reaches the ileocaecal valve. Hence, an obstruction in the proximal part of the ileum could be considered as an early stage in the picture. In two cases the obstruction was situated, however, about two feet proximal to the ileocaecal valve.

At laparatomy many of the cases with obstruction showed markedly enlarged mesenteric lymph glands. A histological examination of the lymph glands revealed only an acute inflammatory sinus catarrh. Free fluid was always present in the peritoneal cavity. The fluid was clear and straw coloured. This was probably due to an associated inflammatory reaction.

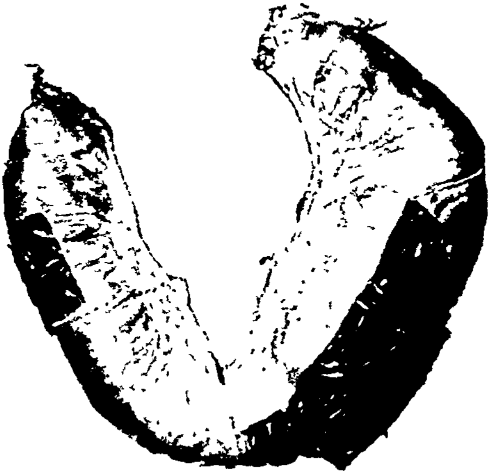

FIG. 1. A loop of small intestine tightly packed with worms causing gangrene.

INTUSSUSCEPTION ASSOCIATED WITH ASCARIS

Though rare, intussusception can certainly be caused by the roundworm (PAUL, 1945), although it is, of course, sometimes difficult to eliminate the possibility of coincidence. In the cases reviewed, four such examples were encountered. A sudden change from breast to bottle feeding may possibly cause a hyperperistalsis of the intestine which, aggravated by the irritation due to the presence of roundworms, may be the immediate casual factor in initiating intussusceptions and volvuli. The intussusception itself cannot contain a mass of worms. Nevertheless, cases have been reported where a single ascaris has been found adherent to the mucosa of the small bowel producing the intussusception (OCHSNER *et al.*, 1949).

CASE REPORTS

Case I. M.A.L., male, 9 years, admitted for fever and abdominal pain of four days' duration. The pain was of a colicky nature with a history of a previous passage of blood in the stools with roundworms. An enema produced a poor result, but there was blood and mucus in the stool with two roundworms. An epigastric lump could be felt, the abdomen was soft and slightly tender. A laparotomy showed that the caecum was congested and thickened with a dimple pathognomonic of a reduced intussusception, probably following the enema. The peritoneal cavity contained some clear serous fluid. There were masses of ascarids in the ascending colon and the small intestine ; the mesenteric glands were enlarged. No worms were seen in the peritoneal cavity. The child had a diarrhoea for a few days and left hospital in two weeks. The diarrhoeal stool on culture showed no Shigellae nor Salmonellae.

Case II. A.K., 4½ years, female, transferred from a peripheral hospital for abdominal pain, vomiting and constipation of three days' duration and a history of having passed masses of worms *per rectum.* A well-defined lump was felt in the left iliac fossa. The abdomen was rigid. A rectal examination showed blood and mucus. At laparotomy, an ileocaecal intussusception reaching the pelvic colon was found and, though reduced with difficulty, the caecum had a few gangrenous patches. There were in addition, two live roundworms, which had probably escaped from the colon into the greater omentum, though no perforation could be detected. There was also a number of worms in the small intestine. At this stage the child's condition was low and the gangrenous areas were only invaginated and sutured, as a resection could not be done. The child, however, expired on the following day. A similar case has been reported by GRADWOHL and KOURI (1948).

Case III. Kanthi, female, 2 years, admitted for abdominal pain and passing blood and thirty-four roundworms *per rectum* since that morning. The child had been given a single dose of piperazine citrate four days ago. The abdomen was distended, no lump was palpable, but rectal examination revealed blood and mucus without faeces. At laparotomy an ileocaecal intussusception, which was reduced easily, was found with masses of roundworms in the small intestine. The child made an uneventful recovery and left hospital in ten days.

Case IV. A., male, 3 years, admitted with a history of abdominal pain and distension of three days, and vomiting roundworms. The abdomen was distended with tenderness round the umbilicus and a palpable lump in the right hypochondrium. Rectal examination showed blood and mucus. At operation an ileocaecal intussusception was found and reduced. The proximal part of the ileum had many roundworms in it. Postoperative progress was uneventful except that the child vomited roundworms and passed about fifty others *per rectum.*

VOLVULUS CAUSED BY THE ASCARIS

A volvulus caused by the ascaris is rare and often fatal. PATOIR and LIDAUX (1942) have reported a few cases. In this series, three such are described.

Case V. O.R.P., male, 4½ years, was admitted with abdominal pain and vomiting of four days' duration. The abdomen was grossly distended. The child was toxic. At operation, the small intestine was grossly dilated. About two feet of the small intestine, packed with roundworms, was gangrenous due to a volvulus around a band. The rest of the ileum too had masses of roundworms. The gangrenous loop was resected and an anastomosis done. The child expired a few minutes after the operation.

Case VI. J., male, 1 year 9 months, admitted with abdominal pain and vomiting of three days' duration, with two roundworms in the vomitus. The abdomen was soft, but distended. There were crepitations in both lungs and tenderness in the left iliac fossa. At operation, there was serous fluid in the peritoneal cavity. About eight inches of the ileum had rotated on its mesentery producing a volvulus with roundworms packed in the loop. The volvulus was untwisted and the ascarids milked into the caecum. The child had a high temperature post-operatively and died on the following morning.

Case VIII. P., female, 3 years 2 months, admitted with diarrhoea and vomiting of three days duration. The child had vomited three roundworms. The abdomen was distended, tense, tender and rigid. On rectal examination no lump was found, and there was no blood or mucus. Laparotomy was done on the next morning, when a volvulus of the small intestine, containing a large mass of roundworms, was found. Serous fluid was found in the peritoneal cavity. The volvulus was untwisted, but the worms were not milked into the caecum, although the gut was viable. The wound was closed. The child expired within a few hours.

In these three cases, different forms of treatment were attempted — that is resection, untwisting the loop and milking the worms, and simple untwisting — but all ended fatally. Volvulus in adults has a high mortality rate of about 50-60 per cent. and naturally in infants, as the fluid-electrolyte balance is more easily upset, a higher mortality rate is inevitable. Late diagnosis had undoubtedly been the main cause of this high mortality rate. Unlike in volvulus in the adult, the twisted loop is not ballooned out, but is packed with the worms. Probably the weight of the collected worms in a loop with a long mesentery associated with the hyperperistalsis causes the loop to rotate and twist.

ACUTE OBSTRUCTION WITH PERITONITIS DUE TO ASCARIS

Ascaris peritonitis is due to penetration of the intestinal wall by roundworms. Affected children also commenced their acute illness with vomiting and often following a vermifuge. This sequel was most common where santonin powders had been previously given, less common where diethylcarbamazine (" Hetrazan ") has been given. Where piperazine citrate has caused abdominal pain and its sequelae, the single massive dose had been given. Hence it is perhaps more the injudicious use of vermifuges rather than the drugs themselves that causes obstruction.

There is usually a history of abdominal pain and fever at the commencement of the illness with a temperature ranging from 99°F. to 101°F. Abdominal distension is marked and extreme in most cases. Tenderness may be localised to the right iliac fossa, but is more often generalised. Very seldom is the classical boardlike rigidity seen in cases with perforations with roundworms in the peritoneal cavity ; often there is no rigidity and the temperature is not above 99°F. Vomiting is moderate, while diarrhoea is frequent. The liver dullness is often obliterated. Intestinal movements are faint or inaudible. The pulse is rapid, feeble and irregular. Often there are crepitations in the lungs, which add to the hazards of operation. In the latter stages the Hippocratic facies with restlessness is seen. The clinical picture is often confusing.

Case VIII. P., male, 1 year 5 months, admitted with abdominal distension of one day's duration and the vomiting of roundworms. The abdomen was grossly distended, soft, without rigidity or tenderness ; no lumps were felt. The child was poorly nourished. The temperature was 99°F. The child's condition was too poor for operation, and he was treated with continuous gastric suction, with intravenous salines and glucose and penicillin. The pulse improved on the following day, and, as the distension was less, operation was postponed, but intravenous fluids and antibiotics were continued. The temperature was between 99° and 100°F. and, in three days, the distension had almost disappeared and the child passed a stool, and there was no vomiting. However, on the sixth day after admission, the child suddenly collapsed and died within half an hour. Post-mortem examination showed a large amount of greenish fluid in the peritoneal cavity : the appendix was perforated at the tip while the rest of the organ appeared to be normal. There was, in addition, a perforation of the jejunum near the duodenal flexure and fifteen roundworms, some alive, were found in the peritoneal cavity. If an early laparotomy had been done the child might have been saved.

In acute obstruction with peritonitis at operation, a perforation with ascarids in the peritoneal cavity is often found. In this series, no perforations were found, although a search was made in four cases. In the remaining cases (Table II) a perforation was found either in the appendix, ileum or jejunum. Many examples have been reported where no perforations were detected, although live roundworms were found in the peritoneal cavity. Various explanations have been given for this. FREUDENTHAL (1923) was of opinion that the worm develops from the larval stage in the abdominal cavity itself ; while GIRGES (1934) believed that the sequence of events may be explained by nibbling of the mucosa, with resulting abscess formation, and subsequent pressure from the parasite producing the perforation.

According to MILDWIDSKY (1945), the attachment of the roundworm to the intestinal wall, whether directly or by way of secretions from the worm, has not been settled. He thinks that the worms may settle on the mucous membrane and create sufficient damage to enable them to penetrate all layers. Whatever the explanation, if the intestinal wall is stretched and a tiny hole is made in the taut muscle wall, the hole may automatically become sealed once the worm escapes and the distension of the intestine is lessened.

GIRGES (1934) suggests that the worm, by means of its denticulated lips and strong muscular pharynx, was capable of sucking in parts of the intestinal wall thereby causing damage to it. Repetition of this performance several times might enable the worm to perforate the intestinal wall. A few observers have noted at post-mortem the appearance of pricks surrounded by red circles in the intestinal mucosa (BLANCHARD, 1934). These injuries might produce abscesses, if secondarily infected. Thus a form of plastic peritonitis could be formed by these small perforations. OCHSNER and others report a case where a roundworm was found penetrating between two loops of the bowel which were adherent to one another.

ALFEEVA (quoted by GIRGES) believed that the ascaris could move actively through the living tissues of the gut wall making long sinuses in its passages.

PERFORATIONS OF THE APPENDIX

There were five cases in which, at operation, there were perforations at the tip of the appendix with the rest of the organ appearing normal to the naked eye.

Case IX. Isaac, male, 3 years, admitted from a peripheral hospital for abdominal distension and vomiting of ten days' duration ; admission temperature of 100°F. The abdomen was distended and soft, with generalised tenderness. No intestinal sounds were heard. At operation two roundworms were found free in the peritoneal cavity. They were dense adhesions. Free fluid was sucked out and the abdomen closed, as the child's condition was poor. The child expired six days later and, at post-mortem, all the coils of the small intestine were adherent to each other with greenish pus between the adhesions. There was a perforation at the tip of the appendix ; the rest of the organ appeared to be normal except for the pus around it. There were two more roundworms in the peritoneal cavity, which were dead and showed signs of disintegration. There were only six other worms in the whole of the intestines. There was a number of small acute ulcers in the stomach.

Four other cases with perforations at the base of the appendix and with roundworms in the peritoneal cavity, but with the rest of the organ showing early signs of inflammation. are also included. In these four cases the perforation was primarily due to the worms. In 1955, 16 children were operated on with acute appendix with three deaths ; of these, 8 had perforations and only in three of them were there roundworms found in the peritoneal cavity and only one case died after operation. There were ascarids in the small intestine in all these cases.

There were perforations of the jejunum in two cases and in the ileum in four. The number of roundworms lying free in the peritoneal cavity, sometimes dead, varied from one to as many as fifty. In one case, a worm was found at operation, with a portion of its body protruding through a minute perforation in the ileum which closed on its own after pushing the worm back into the lumen ; a purse-string suture was inserted as an additional safeguard. There were no other worms in the peritoneal cavity and the child made an uneventful recovery. This child was readmitted one year later for an acute abdomen when dense adhesions were found and, on breaking down these, there were localised abscesses which were drained. The child developed a faecal fistula which closed on its own and she left hospital after one month.

It is not uncommon to see ascarids in a suppurating and gangrenous appendix (EINHORN et al., 1945). Several cases that have been operated on for acute appendicitis, have demonstrated only a live worm occupying the whole length of the appendix, with early inflammation, the worm thus acting as an obstruction, in the same way as a faecolith.

Case X. Chandralatha, female, 1½ years, admitted with fever and abdominal distension of three days and pain and vomiting of one day's duration. The temperature was normal on admission, and the abdomen was soft. A lump could be felt in the right hypochondrium. Laparotomy was done and the lump was found to be an enlarged fatty liver. A long appendix with a live round-worm within it was seen. The worm was milked into the caecum and appendicectomy done. The child made an uneventful recovery.

When the inflammatory process in the appendix is due to the mechanical obstruction produced by the worms and to their irritative action, or whether the presence of worms in the appendix is coincidental in an inflamed appendix, is controversial. Both types seem to occur.

In another case at laparotomy, dense adhesions with worms in the peritoneal cavity were found. Four roundworms were removed and the pus sucked put. No search for the perforation was made as the child's condition was poor. Three days later, an adult roundworm made its way out through the wound and another, two days later. The child left hospital well one month after the laparatomy.

The adult ascaris may find its way to any organ with resultant abscess formation. Maxwell (1934) described a tubo-ovarian abscess containing a live ascarids. The commonest site is the paracolic gutter and in the subdiaphragmatic space under the liver, where they may form a liver abscess. Liver abscesses due to the roundworm have been reported by de Silva (1954), and by McNamara (1943). These are usually multiple and the pus is foul. They may rupture into the peritoneal cavity and occasionally into the thorax. Wyss (1928) has reported two cases ; while Ochsner et al. (1949) two others — (a) in a girl of 20 months, with 24 adult roundworms in the liver ; (b) in a girl of 12 months, with adult roundworms in the liver. Perforation of the lower end of the oesophagus with haematemesis has also been reported by de Silva and others.

As with the appendix, a Meckel's diverticulum can also be the site of the lesion. Paul and Goonewardene (1953) have reported two cases from this hospital, where roundworms had escaped into the peritoneal cavity through an acutely inflamed Meckel's diverticulum. This is a rare condition, and only three cases had been reported in Ceylon from 1927 to 1950 (Paul and Goonewardene, 1953). In this series two further cases are reported.

Case XI. T.A W , male, 1 year 9 months, admitted with a history of swelling and protrusion of the umbilicus of two weeks' duration The child had passed 14 worms through the umbilicus. The abscess resolved with antibiotics and the child passed a number of worms *per rectum* after a course of treatment with vermifuges He left the hospital well in three weeks, and was advised to report in a month's time for removal of the Meckel's diverticulum.

Case XII W , male, 5 years, admitted with a history of pain round the umbilicus of one week's duration On examination there was a small indurated lump beneath the umbilicus ; it was tender and warm It was diagnosed as an abscess, and antiphlogistine locally and penicillin injections given for one week when the induration settled down, but the child passed three worms with pus through the umbilicus He was readmitted one month later with a sinus by the side of the umbilicus At laparotomy, a large. number of whitish nodules scattered all over the peritoneal surface was seen It was diagnosed as tuberculous peritonitis, but no biopsy material had been taken In spite of the erythrocyte sedimentation rate being normal, the child was given para-amino-salicylic acid and streptomycin for one month and the sinus healed He was readmitted one year later with fever and a lump beneath the scar. A lump was seen alongside the umbilicus It was warm and tender. The rest of the abdomen was soft. On rectal examination, no lump was palpable The Mantoux reaction was negative. The erythrocyte sedimentation rate (Westergren) first hour was 12 mm , and 26 mm at the end of the second hour. An incision made over the scar into the lump, which was diagnosed as an abscess, showed a little serous fluid and two live roundworms which were removed and the wound sutured A plain x-ray of the abdomen showed a worm like shadow in the cyst wall and a barium meal was suggestive of a Meckel's diverticulum A laparotomy was done and a Meckel's diverticulum was found adherent to the anterior adbominal wall forming a cystic space walled by the omentum The diverticulum was divided between clamps and the stump sutured. A stab incision was made into the cyst wall and the pus drained A large, dead, adult roundworm was found in the cyst The adhesions were dissected out and the wound closed with a drain in the cyst cavity. The child made an uneventful recovery and left hospital. There were no nodules in the peritoneal cavity on this occasion. The child was seen six months later and had no complaint.

Pieris (1954) reported a case who had had a laparotomy in this hospital for roundworm obstruction with peritonitis. There was free serous fluid in the abdomen with coils of small intestine, which were red, angry-looking and distended. There were fibrinous adhesions between the coils of the small intestine. On the serous coat of the ileum and omentum there were several small tubercle-like nodules. On section Dr. G. H. COORAY, Professor of Pathology, University of Ceylon, reported as subacute ascaris ova peritonitis due to the presence of helminth ova, which appeared to be ova of ascaris. AFRICA and GARCIA (1936) have reported a similar case from the Philippine Islands; while two other cases have since been reported from the U.S.A. (JENKINS and BEACH, 1954 and MOORE, 1954).

OBSTRUCTION IN THE BILIARY TRACT

The ascarids may enter the biliary or pancreatic radicules producing obstruction and infection in them. This complication is not infrequent. Thus, ADAMS (1935) reported a case of a 73-year-old man with upper abdominal pain, in whom exploration revealed 3 litres of bile in the peritoneal cavity. Autopsy revealed a rent in the hepatic duct through which an adult female ascaris protruded, resulting in escape of bile. The gall bladder contained seven adult worms and the bile ducts of the right lobe of the liver, ten. OCHSNER and others (1949) report a case in a child and believe that it occurs in patients with abnormal papillae of the common bile ducts.

Acute haemorrhagic and suppurative pancreatitis has been considered to be due to a worm blocking the ampulla of Vater or the duct of Wirsung. NOVIS (1923) reported a case of acute pancreatitis in a 12-year old Hindu girl in whom the pancreas was excised, the duct of Wirsung exposed and opened, and two adult ascarids removed.

DIAGNOSIS AND TREATMENT IN SURGICAL COMPLICATIONS OF ASCARIASIS

The presence of an ascaris infection in the various organs produces no pathognomic symptomatic pattern. Since the small intestine is the natural habitat of ascarids, the commonest symptoms are referable to this viscus. These may vary from vague epigastric distress, nausea or vomiting, to the severe excruciating abdominal pain of perforation or obstruction. There is usually a history of vomiting or the passage of roundworms or of the administration of a purgative or vermifuge. There may be associated systemic manifestations such as anaemia, fever, malnutrition, anorexia, lassitude, insomnia, urticaria, headaches and even, rarely, convulsions.

The diagnosis of ascariasis depends on the identification of the ova or the worms in the faeces. Blood examination may reveal anaemia and a low grade eosinophilia. If an x-ray picture of the abdomen is taken after a barium meal, the characteristic string shadows may be seen in massive infestations, which are believed to be due to the barium having been ingested by the roundworms (ARCHER and PATTERSON, 1930).

Many of these cases admitted with a lump, abdominal pain and vomiting due to ascariasis, and often sent into hospital as intussusceptions, do well with high saline enemata daily or twice a day, with large doses of liquid paraffin. Differentiation from intussusception is usually not very difficult. In Ceylon, the ileoileal type of intussusception is rare, while the ileocaecal type is the commonest. In the ileocaecal type, there is a lump either in the right hypochondrium or epigastrium. By contrast, in roundworm obstruction the lump is usually felt in the region of the umbilicus or below, and, in a well relaxed abdomen a doughy abdominal mass is felt and the outlines of the worms may often be easily palpated. In others, more than one lump could be palpated. It is most unlikely to get frank blood and mucus in the stools in intestinal obstruction due to roundworms, unless there is, in addition, an intussusception. Often, traumatic bleeding from a prolapsed rectum (common due to the associated malnutrition) or the injured anal margin is mistaken for blood of an intussusception.

Two methods are commonly employed in the treatment of obstructions ; (1) Manual disengagement of the ascaris bolus without enterotomy, and milking the worms into the caecum by gentle manipulation. However, when the obstruction has been in the terminal part of the jejunum, milking the worms into the large gut may be disastrous. In such cases, disentanglement of the coiled up bolus may be helpful. In the large gut, no obstruction occurs, probably because of the larger lumen and ability to dilate to a greater extent than the small bowel. But, curiously enough, these masses are not readily passed *per rectum*. The use of intestinal antispasmodics, such as atropine methyl nitrate may be helpful. Some toxic products from the worm may perhaps be secreted during manipulation, which may cause severe toxaemia with a high postoperative pyrexia. Paralytic ileus due to handling of the bowel may add to the complications. In this series, 13 cases that had obstruction had the mass of worms milked into the caecum, with one death.

Owing to these reactions, enterotomy with evacuation is believed to be the only safe method. This method often is not practical in our children with massive infestations. Enterotomy is attended by some danger, because any remaining worms — for it is not possible to massage all the worms to the site of the incision — may penetrate the suture line. Strict aseptic technique must be adopted during their removal. However, in a number of cases with worm infestations, the inflamed appendix had been removed without any worms making their way out through the suture line. In this series, 4 children with obstruction due to ascariasis were treated with enterotomy and removal of worms, with one death.

When the worms are tightly packed and enterotomy and removal are difficult, the whole loop of intestine must be resected, and an end-to-end anastomosis performed. Two cases were resected, but both children died. This form of treatment had the highest mortality rate.

In the case of intussusception and volvulus, the former has to be reduced or the latter untwisted, and the mass of roundworms treated in one of the three ways already described. There were four cases of intussusception with one death, and three cases of vulvulus which, were all fatal.

On the third day following operation, piperazine citrate in small doses is given for three or four days. Whenever a child presents himself with the signs and symptoms of intestinal obstruction, the roundworm must be considered as a probable aetiological factor in countries such as Ceylon, where ascaris infestations are very common and often massive. It is difficult to diagnose a volvulus caused by these worms ; a plain x-ray may be helpful. Intussusception should be suspected whenever there is a history of passing blood and mucus *per rectum*.

The injudicious employment of any anthelminthic may result in death of the worms with consequent absorption of their probably highly toxic by-products, and also produce intestinal obstruction due to mass accumulation of the worms or may encourage their migratory habits.

The diagnosis of obstruction of the common bile cystic or pancreatic ducts by ascarids is only made at the time of operation. Invasion of the gall bladder or cystic duct by these parasites required cholecystectomy because of the concomitant infection.

small intestine, which were red, angry-looking and distended. There were fibrinous adhesions between the coils of the small intestine. On the serous coat of the ileum and omentum there were several small tubercle-like nodules. On section Dr. G. H. COORAY, Professor of Pathology, University of Ceylon, reported as subacute ascaris ova peritonitis due to the presence of helminth ova, which appeared to be ova of ascaris. AFRICA and GARCIA (1936) have reported a similar case from the Philippine Islands; while two other cases have since been reported from the U.S.A. (JENKINS and BEACH, 1954 and MOORE, 1954).

OBSTRUCTION IN THE BILIARY TRACT

The ascarids may enter the biliary or pancreatic radicules producing obstruction and infection in them. This complication is not infrequent. Thus, ADAMS (1935) reported a case of a 73-year-old man with upper abdominal pain, in whom exploration revealed 3 litres of bile in the peritoneal cavity. Autopsy revealed a rent in the hepatic duct through which an adult female ascaris protruded, resulting in escape of bile. The gall bladder contained seven adult worms and the bile ducts of the right lobe of the liver, ten. OCHSNER and others (1949) report a case in a child and believe that it occurs in patients with abnormal papillae of the common bile ducts.

Acute haemorrhagic and suppurative pancreatitis has been considered to be due to a worm blocking the ampulla of Vater or the duct of Wirsung. NOVIS (1923) reported a case of acute pancreatitis in a 12-year old Hindu girl in whom the pancreas was excised, the duct of Wirsung exposed and opened, and two adult ascarids removed.

DIAGNOSIS AND TREATMENT IN SURGICAL COMPLICATIONS OF ASCARIASIS

The presence of an ascaris infection in the various organs produces no pathognomic symptomatic pattern. Since the small intestine is the natural habitat of ascarids, the commonest symptoms are referable to this viscus. These may vary from vague epigastric distress, nausea or vomiting, to the severe excruciating abdominal pain of perforation or obstruction. There is usually a history of vomiting or the passage of roundworms or of the administration of a purgative or vermifuge. There may be associated systemic manifestations such as anaemia, fever, malnutrition, anorexia, lassitude, insomnia, urticaria, headaches and even, rarely, convulsions.

The diagnosis of ascariasis depends on the identification of the ova or the worms in the faeces. Blood examination may reveal anaemia and a low grade eosinophilia. If an x-ray picture of the abdomen is taken after a barium meal, the characteristic string shadows may be seen in massive infestations, which are believed to be due to the barium having been ingested by the roundworms (ARCHER and PATTERSON, 1930).

Many of these cases admitted with a lump, abdominal pain and vomiting due to ascariasis, and often sent into hospital as intussusceptions, do well with high saline enemata daily or twice a day, with large doses of liquid paraffin. Differentiation from intussusception is usually not very difficult. In Ceylon, the ileoileal type of intussusception is rare, while the ileocaecal type is the commonest. In the ileocaecal type, there is a lump either in the right hypochondrium or epigastrium. By contrast, in roundworm obstruction the lump is usually felt in the region of the umbilicus or below, and, in a well relaxed abdomen a doughy abdominal mass is felt and the outlines of the worms may often be easily palpated. In others, more than one lump could be palpated. It is most unlikely to get frank blood and mucus in the stools in intestinal obstruction due to roundworms, unless there is, in addition, an intussusception. Often, traumatic bleeding from a prolapsed rectum (common due to the associated malnutrition) or the injured anal margin is mistaken for blood of an intussusception.

Two methods are commonly employed in the treatment of obstructions ; (1) Manual disengagement of the ascaris bolus without enterotomy, and milking the worms into the caecum by gentle manipulation. However, when the obstruction has been in the terminal part of the jejunum, milking the worms into the large gut may be disastrous. In such cases, disentanglement of the coiled up bolus may be helpful. In the large gut, no obstruction occurs, probably because of the larger lumen and ability to dilate to a greater extent than the small bowel. But, curiously enough, these masses are not readily passed *per rectum*. The use of intestinal antispasmodics, such as atropine methyl nitrate may be helpful. Some toxic products from the worm may perhaps be secreted during manipulation, which may cause severe toxaemia with a high postoperative pyrexia. Paralytic ileus due to handling of the bowel may add to the complications. In this series, 13 cases that had obstruction had the mass of worms milked into the caecum, with one death.

Owing to these reactions, enterotomy with evacuation is believed to be the only safe method. This method often is not practical in our children with massive infestations. Enterotomy is attended by some danger, because any remaining worms — for it is not possible to massage all the worms to the site of the incision — may penetrate the suture line. Strict aseptic technique must be adopted during their removal. However, in a number of cases with worm infestations, the inflamed appendix had been removed without any worms making their way out through the suture line. In this series, 4 children with obstruction due to ascariasis were treated with enterotomy and removal of worms, with one death.

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When roundworms are found in the gall bladder, they not infrequently are also present in the common duct and hence this should also be explored. Decompression of the biliary radicles by drainage may encourage any worms remaining to find their way into the duodenum. An ascaris has been known to make its exit through the T-tube on the tenth postoperative day (YOUNG and LAMB, 1946).

SUMMARY

The incidence of roundworm infestation in children is given, as found in Ceylon. Fifty cases requiring surgical intervention are analysed. The types of lesion are discussed :—(1) Obstruction due to the mechanical effect of a mass of ascarids ; (2) Peritonitis with migration of roundworms into the peritoneal cavity ; (3) Volvulus and intussusception caused by the ascaris are also described ; (4) Perforation of the appendix ; (5) Obstruction of the biliary tract. The diagnosis and treatment adopted in the different cases are discussed.

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A SIMULTANEOUS STUDY OF BONE MARROW OF NEWBORN BABIES AND THEIR SEVERELY ANAEMIC MOTHERS[*]

by

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(Department of Pathology, Chittaranjan Seva Sadan College of Obstetrics, Gynaecology and Child Health, and Chittaranjan Cancer Hospital, Calcutta, India).

This paper deals with the simultaneous study of bone marrow of anaemic Indian mothers and their babies. It seems from the available literature that no such study has been recorded previously, although Zellerstrome (1954) reported one case where he found megaloblasts in bone marrow of a three months old baby born of anaemic mother suffering from pernicious anaemia. Bone marrows of newborn babies, however, were studied by Tecilazic (1935), Veeneklass (1938), Sapiro and Bassen (1941) and Graser *et al* (1948) and Gairdner *et al* (1952, 1955).

MATERIAL AND METHODS

Thirty Indian, mainly Bengali, newborn babies (nine of normal mothers and the rest of severely anaemic mothers) were the subjects of the study, together with their mothers. Out of these twenty-one anaemic women, nine were classified as nutritional microcytic (iron deficiency), seven were nutritional macrocytic (folic acid, vitamin B_{12} and protein deficiency), and five were suffering from dimorphic anaemia.

Bone marrow was aspirated from the iliac crest of the newborn babies on the 3rd to 5th day in 28 cases, in one case on the 12th day and the other on the 16th day of life. Sternal marrow was examined from the mothers. Simultaneous study of peripheral blood was also done in both the mothers and their babies. The babies included both mature and "premature" infants (less than 5 lb. 8 oz. and with the estimated gestation period between 38 - 40 weeks).

RESULTS

The peripheral blood smear of babies of normal and anaemic mothers on the third to fifth day showed relative lymphocytosis, macrocytosis, slight anisocytosis. Target cells also were found occasionally in some of the cases. Normoblasts were very scarce, except in the "premature" babies.

(i) *Babies of normal mothers*

The average total nucleated cell count was found to be 48,500 (38,400 to 57,000) per cmm. of bone marrow (Table I). Normoblasts were 21.5 per cent., lymphocytes 17.5 per cent. and granular cells 58.0 per cent. respectively on an average. The myeloid - erythroid ratio was 2.8 : 1. The morphological character of normoblasts, granular cells, and lymphoid cells did not present any significant abnormality and conformed to that seen in their mothers. Regarding megakaryocyte as it was very difficult to make a thicker type of smear with the bone marrow of the newborn babies, it was hard to get an adequate number

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When roundworms are found in the gall bladder, they not infrequently are also present in the common duct and hence this should also be explored. Decompression of the biliary radicles by drainage may encourage any worms remaining to find their way into the duodenum. An ascaris has been known to make its exit through the T-tube on the tenth postoperative day (YOUNG and LAMB, 1946).

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found to be increased (32.5 per cent.). A few macronormoblasts as described above were also observed, but unfortunately the blood proteins of these babies could not be done. The myeloid - erythroid ratio was 1.7 : 1.

TABLE II. Bone marrow findings in nutritional macrocytic and dimorphic anaemia mothers and their babies.

	Nutritional Macrocytic Anaemia (7 cases) 4.2 gm.%		Dimorphic Anaemia (7 cases) 4.2 gm.%	
	Mothers	Babies	Mothers	Babies
Total nucleated cells (x 1000)	81.5 (63.0-120.0)	58.2 (43.2-67.0)	102.0 81.4-179.0)	75.0 (58.0-86.0)
Erythroid series				
Normoblast (%)	31.5 (23.5-49.3)	28.0 (18.5-37.4)	47.0 (35.5-53.3)	23.3 (16.2-33.0)
Micronormoblast (%)	0.0	0.0	2.3 (1.0-3.5)	2.0 (1.3-3.0)
Macronormoblast (%)	6.5 (3.0-12.5)	3.5 (2.3-8.5)	4.8 (1.5-5.5)	2.5 (1.0-4.8)
Megaloblast (%)	2.5 (4 cases)	0.0	3.0 (3 cases)	0.0
Mitotic cells (%)	5.5 (3.5-7.5)	4.5 (2.5-6.5)	6.5 (4.8-8.5)	2.8 (1.5-4.0)
Myeloid series				
Granular cells (%)	43.5 (35.5-57.5)	48.6 (37.5-59.5)	38.2 (29.5-50.5)	42.5 (31.5-52.5)
Giant Metamyelocyte	6.2 (5.3-13.5)	5.5 (2.5-6.8)	7.5 (2.5-12.0)	4.5 (2.3-5.6)
Giant stab (%)	6.0 (2.2-8.4)	3.5 (1.5-6.5)	2.3 (1.0-6.0)	2.5 (1.0-4.5)
Macropolycites (%)	3.4 (2.5-6.5)	3.5 (1.5-4.5)	2.5 (1.0-6.0)	0.5 (0.0-3.0)
Megakaryocytes (%)	1.0 (0.5-1.5)	1.2 (0.0-2.0)	1.5 (0.0-3.0)	0.75 (0.0-1.5)
Giant Megakaryocytes	Present (5 cases)	Present (2 cases)	Present (4 cases)	Present (1 case)
Lymphocytes (%)	6.8 (4.0-18.0)	19.5 (9.0-28.0)	9.0 (6.5-23.0)	21.0 (13.0-30.0)
Myeloid-erythroid ratio	1.5 : 1	1.7 : 1	0.9 : 1	1.6 : 1

The presence of macronormoblasts in the bone marrow of the patients suffering from anaemia and protein malnutrition, has been described by TROWELL (1949), and MEHATA and GOPALAN (1957) in kwashiorkor. The latter works also observed the finer chromatin network of the nuclei of macronormoblasts and large metamyelocytes in some of their cases. WOODRUFF (1955) observed macronormoblastic hyperplasia of bone marrow in anaemia of pregnancy associated with malnutrition. The average plasma protein level of his cases was 7.37 gm., the albumin being 3.15 gm. Hence this abnormal disposition of the chromatin structure in the nuclei may be due to a severe degree of hypo-proteinaemia. Of course, the role of other erythrocyte maturing factors cannot be denied.

(iv) *Babies of dimorphic anaemia mothers.*

The average haemoglobin values of mothers of this group was 4.0 gm. per 100 ml. (3.6 to 5.2 gm). The bone marrow smear of the mothers showed macronormoblasts with non-haemoglobinised cytoplasm intermingled with a few micronormoblasts. Giant metamyelocytes, giant stab, and macropolycites were also found. The myeloid - erythroid ratio was 0.9 : 1.

The bone marrow of the abies showed moderate hypercellularity with macronormoblasts, hypochromic micronormoblasts, giant metamyelocytes, giant stab cells similar to those of their mothers. The myeloid - erythroid ratio was 0.7 : 1.

of megakaryocytes in a particular case, but with this limitation in view, our observation tends to indicate that there was preponderance of premature types of megakaryocytes. Though average erythrocytes were macrocytic, normoblasts were of usual normal size. No significant difference could be observed in the bone marrow picture of six normal and three " premature " babies. In their series of twenty-nine bone marrow aspiration studies of prematurely newborn babies, GAIRDNER *et al* (1955) did not find any morphological difference in the erythroid cells of mature and premature babies. Their findings did not support the existence of often-quoted functional immaturity of bone marrow of premature babies as suggested by LICHTENSTEIN and NORDENSON (1939). Our observations and also that of JOPPICK (1948) corroborate the findings of GAIRDNER *et al* (1955).

TABLE I. Bone marrow findings in normal and nutritional microcytic anaemia mothers and their babies.

	Normal (9 cases)		Nutritional Microcytic (7 cases)	
	Mothers	Babies	Mothers	Babies
Total Nucleated cells (x 1000)	188.0 (89.0-231.0)	48.5 (32.4-57.00)	251.0 (201.0-285.0)	68.9 (59.0-89.5)
Erythroid Series				
Normoblast (%)	28.25 (25.3-41.3)	21.5 (15.5-27.3)	41.0 (28.5-46.5)	34.5 (26.5-39.5)
Micronormoblast (%)	0.0	0.0	18.2 (8.5-21.0)	7.5 (4.5-10.5)
Macronormoblast (%)	0.0	0.0	0.0	0.0
Megaloblast (%)	0.0	0.0	0.0	0.0
Mitotic Cells (%)	0.50 (0.0-1.5)	1.4 (0.5-2.5)	3.5 (2.3-4.8)	5.5 (3.5-7.5)
Myeloid Series				
Granular Cells (%)	66.5 (50.3-71.3)	58.0 (51.3-74.5)	38.2 (28.5-45.5)	43.6 (35.5-52.5)
Giant Metamylocyte	0.0	0.0	0.0	0.0
Giant stab.	0.0	0.0	0.0	0.0
Macropolycite	0.0	0.0	0.0	0.0
Megakaryocytes (%)	1.8 (0.0-3.1)	0.6 (0.0-1.4)	1.5 (0.0-2.5)	1.0 (0.0-1.5)
Lymphocytes (%)	8.7 (6.5-12.3)	17.5 (10.0-26.0)	7.25 (5.2- 155)	13.6 (11.2-26.3)
Myeloid-erythroid ratio	3 : 1	2.8 : 1	0.5 : 1	1 : 1

(ii) *Babies of nutritional microcytic (iron deficiency) anaemia mothers.*

The average haemoglobin value of the mothers was 4.9 (3.5 - 6.4)gm. per 100 ml. The bone marrow of others was hypercellular with a high normoblastic reaction. The myeloid - erythroid ratio was 0.5 : 1. The total nucleated cell count of the babies was higher than those of normal mothers (Table I). The cell count, on an average was 68,900 (50,000 to 89,000) per cm. of bone marrow. The average normoblast percentage was 41.3. The myeloid - erythroid ratio was 1 : 1. The most interesting findings were in the morphological character of some normoblasts, which were smaller in size, with distorted, scanty cytoplasm and very small nuclei. These constituted 7.5 per cent. of total nucleated cells. This type of morphological variation in normoblasts was also found in the bone marrow in their respective mothers.

(iii) *Babies of nutritional macrocytic anaemia mothers*

The average haemoglobin value of the mothers was 4.2 gm. per 100 ml. (3.2 to 5.4 gm.). Bone marrow of the mothers showed macropolycytes, giant metamyelocytes, macronormoblasts and abnormal mitosis in cells, both of erythrocyte and granulocyte series. Bone marrow examination revealed megaloblasts in 4 cases. Over and above this, some of the normoblasts showed peripheral condensation in chromatin material of the nuclei and a central network arrangement of thinner chromatin material in the nuclei in two cases. This peculiar characteristic in the normoblasts was found to be associated with gross hypoproteinaemia (3.6 and 3.9 gm. per 100 ml.). The myeloid - erythroid ratio was 1.5 : 1.

The bone marrow of the babies showed a higher nucleated cell count per cmm. (Table II). The bone marrow also showed macronormoblasts, some giant metamyelocytes and abnormally large megakaryocytes and abnormal mitosis in cells of erythrocyte and granulocyte series. The normoblastic reaction was found to be increased (32.5 per cent.). A few macronormoblasts as described above were also observed, but unfortunately the blood proteins of these babies could not be done. The myeloid - erythroid ratio was 1.7 : 1.

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The bone marrow of the abies showed moderate hypercellularity with macronormoblasts, hypochromic micronormoblasts, giant metamyelocytes, giant stab cells similar to those of their mothers. The myeloid - erythroid ratio was 0.7 : 1.

COMMENTS

The findings obtained in this study give an indication that there exists some correlation between the bone marrow picture of the babies and that of their severely anaemic mothers. This correlation also conforms to the type of anaemia in their mothers. Hence any baby born of a grossly anaemic mother, although he does not look anaemic at birth as judged by the peripheral blood picture, may nevertheless be essentially deficient in the haemopoetic factors which his mother lacks. This deficiency can easily be ascertained by the morphological study of the cellular elements of the bone marrow of the baby. Thus this observation further justifies the rational use of haematinics in the neonatal period of a baby born of anaemic mothers to prevent the anaemia in infancy. It also clearly indicates that anaemia in infancy may be guarded against by improving the haemotological status of mothers in their prenatal period.

SUMMARY

The bone marrow of nine newborn babies of normal mothers and twenty-one babies of severely anaemic mothers were studied along with their mothers. Bone marrow pictures of both mothers and their babies have been recorded and it was observed that there is a haematological correlation between the bone marrow of newborn babies and that of their severely anaemic mothers of different groups viz., iron deficiency anaemia, nutritional macrocytic anaemia and dimorphic type of anaemia. Some macronormoblasts, with peripheral condensation of chromatin and a central network arrangement of thinner chromatin material in the nuclei, were found in the bone marrow smear of anaemic mothers associated with gross hypo-proteinaemia (3.6 and 3.9 gm. per 100 ml.) and their babies.The present findings seem to support the therapeutic use of haematinics in early infancy in children born to anaemic mothers, and also tend to confirm that anaemia of infancy may be guarded against by attention to the haematological status during pregnancy.

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CLINICAL STUDIES ON SOUTH TRINIDADIAN CHILDREN
(I) FATAL MALNUTRITION

by

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One of the most useful indices of a nation's health is probably the infant mortality rate, and, in recent years, there has been a steady fall in Trinidad, until in 1955 this rose again to 67.9 per thousand. Although this compared favourably with the rates for less prosperous Caribbean islands, it is still very much greater than the figures obtainable elsewhere in the world, and, more significantly, it was about one and a half times that of Port of Spain, Trinidad's capital and only large city, where in 1955 the rate was only 45 per thousand.

Although infant mortality rates are subject to error, there was no reason to believe that they were as fallible in Trinidad as in less sophisticated areas (ROBINSON, 1955) and it seemed that this difference of more than 20 per thousand was a valid one. From this it followed that children outside Port of Spain were dying from preventable conditions and an attempt was therefore made to determine the common causes of death and especially the frequency of fatal malnutrition in rural infants.

METHOD

Death certificates are an uncertain source of such information and since in Trinidad a certificate may be given by any doctor who has seen either the patient or the body, there is ample scope for inaccuracy. In an attempt to obtain more reliable information, permission was sought for an autopsy on each child dying in the pediatric and infectious wards of the San Fernando Hospital, which draws its cases from a predominantly rural population remote from Port of Spain. The few cases dying in the surgical wards were excluded, since most of them were subjected to forensic autopsies, records of which were not available. Initially, children dying soon after admission were excluded from the investigation, but in the second year all deaths were included unless there was some definite medico-legal contra-indication.

Comparison of the figures obtained showed no difference in the causes of death in the two groups, but there appeared to be a sex distinction to which reference will be made later.

Between April 1st 1955 and April 1st 1957, 294 children under 10 were included in this series and of these, 277 (94 per cent) were autopsied. Of these 294 children, 94 were between one and ten years and 163 between one month and one year, but only 37 were younger than one month.

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* I am grateful to the Director of Medical Services for permission to publish, and to Dr. Dos Santos, Dr. Arneaud and Professor G. Bras for histological reports on many of the cases in this series.

RESULTS

The findings obtained in 163 infants aged between 1 month and 1 year are outlined in Table I, and in Figs. 1 and 2, they are compared with those in the 94 children between one and ten years investigated in the same two year period.

Preliminary study of this series of deaths revealed two curious points ; in the first place, neonates provided an unexpectedly small proportion (18.5 per cent.) of the 200 infant deaths compared with 44.7 per cent. of Trinidad's 2,052 infant deaths in 1955, suggesting that the present series might not be representative. This suspicion was confirmed, and neonatal deaths were excluded, when it was found that so few infants were admitted in the first week of life that prematurity, together with the cerebral and respiratory complications of birth, accounted for only one quarter of the neonatal deaths, most of which were due to infection. Experience of deliveries in hospital did not suggest that infants in Trinidad had any immunity from intranatal hazards and there seemed little doubt that babies who were obviously feeble at birth, especially if they were delivered by untrained attendants, died without medical care, and probably sometimes without achieving the dignity of a recorded existence. Early notification of births, without the three months' delay which is allowed at present, and the provision of enough health visitors to see all neonates soon after delivery might give some idea of the causes of death in this age-group.

TABLE I. Cause of death in 163 children aged between 1 month and one year dying in the General Hospital, San Fernando (1955-57). (Diagnosis based on combined clinical and autopsy findings.)

	1955-56		1956-57	
	Male	Female	Male	Female
Malnutrition				
Underfeeding	7	2	6	8
Kwashiorkor	10	2	10	5
Underfeeding and prematurity	2	—	2	—
Malnutrition and Infection				
Underfeeding and pneumonia	4	1	3	4
Kwashiorkor and pneumonia	6	2	5	4
Underfeeding and gastro-enteritis	3	6	7	8
Kwashiorkor and gastro-enteritis	—	—	2	2
Underfeeding and cleft palate and pneumonia	—	1	—	—
Infection				
Pneumonia	2	2	3	5
Gastro-enteritis	5	1	4	3
Meningitis	3	—	—	1
Pneumococcal peritonitis	—	1	—	—
Gastro-enteritis and tuberculosis	—	—	1	—
Miscellaneous				
Congenital heart disease	2	3	3	1
Biliary atresia	—	1	—	—
Hydronephrosis	—	—	2	1
Acute nephritis	—	1	—	—
Ascariasis	—	—	—	1
Epidermolysis bullosa	1	—	—	—
Congenital syphilis	—	—	—	1
Leukaemia	—	—	—	1
Anaemia (? Nutritional)	—	—	1	—
Fibrocystic disease of the pancreas	—	—	1	—

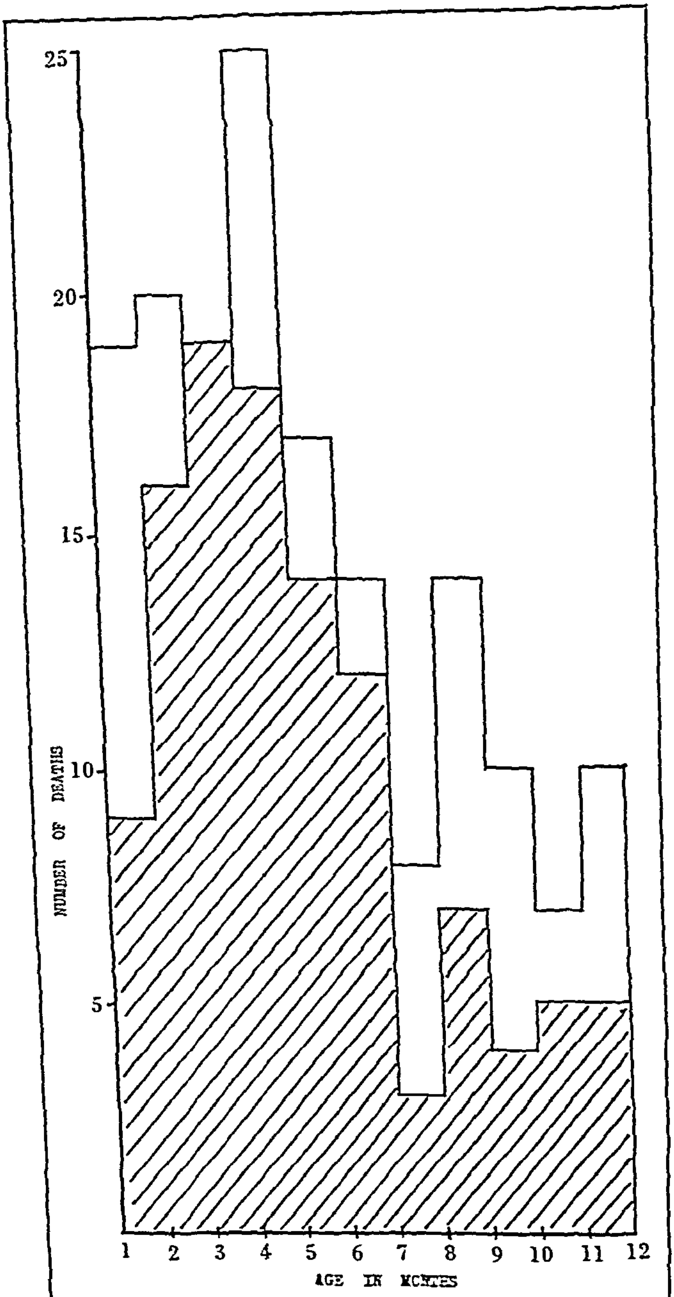

Fig. 1. Deaths at ages 1 month to 1 year (Nutritional deaths shaded).

The solution of the problem awaits the existence of enough midwives to attend all home confinements, together with home help for the domestic duties which are at present included in the service offered by untrained, but not by trained, midwives.

Another unexpected finding was that females formed 34 per cent of 68 deaths in the first year, but 47 per cent of 95 deaths in the second year of the investigation. The most prominent difference between the two years was the initial exclusion of cases dying within a few hours of admission. Further study is necessary to determine why there is a significant tendency for girls to reach hospital at a later stage of their illness.

One point stands out above all from these figures. This is that in Trinidad the study of infant mortality is the study of infant malnutrition. Of the 163 deaths occurring between one month and twelve months, malnutrition was the cause in 33 per cent and a major contributory factor in 36 per cent.

In a community where the duration of gestation is uncertain and the birth weight unknown, and where normal growth standards have not yet been established, the diagnosis of malnutrition may appear to present difficulties. Very many of the children admitted

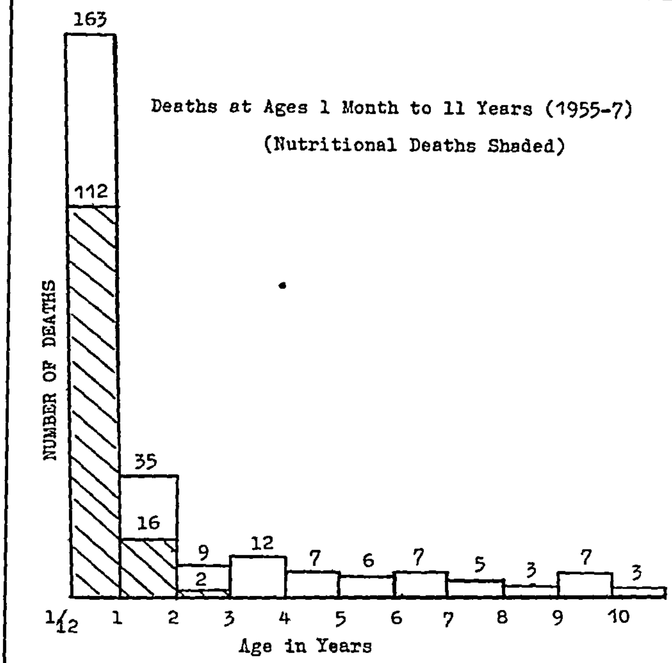

Fig. 2. Deaths at ages 1 month to 11 years (Nutritional deaths shaded).

to hospital here are a few pounds underweight by the standards of Europe or North America, but in the present series infants were considered malnourished only if their nutritional state was severe enough to call for hospital treatment, even in the absence of some complication such as pneumonia or gastro-enteritis. Weight has not been used as the sole criterion of nutrition.

Included under the general heading of malnutrition were many cases of the syndrome once known by the various names listed by TROWELL et al. (1954) and now popularly but, in the West Indies, inaccurately known as kwashiorkor. As seen in San Fernando (SYMONDS and MOHAMMED, 1956), this was a disease of the second and third trimesters, beginning usually with vomiting followed by anorexia, oedema, or oliguria. By the time they reached hospital, many of these children had developed evidence of infection, such as cough, dyspnoea or loose stools.

On examination, there was rarely much loss of body solids and the face in particular was usually fat and doll-like. Almost all cases had moderate or severe hepatomegaly and most showed some pitting oedema of the extremities. The classical dermatosis of kwashiorkor was occasionally present (Fig. 3), but in most cases the skin appeared normal (Fig. 4) or only slightly glazed. In some of these, desquamation followed if the child survived. Hair changes were infrequent, and when they occurred, seemed to be related rather to the duration than to the type of nutritional deficiency. In one case the finger and toe nails were shed soon after the skin had desquamated, but this occurred in an infant whose skin involvement was severe and whose illness ran an unusually long course.

At autopsy, there was gross fatty infiltration of the liver, usually without naked-eye changes in the pancreas or other organs.

The other malnourished children in this series were examples of underfeeding and exhibited only failure of growth and loss of subcutaneous and muscle tissue (Fig. 5), while at autopsy the sole finding was the absence of body fat and moderate atrophy of most organs. A few of these emaciated infants had minimal hair or skin changes of the type found in kwashiorkor, but these were not considered as a separate group. The spectrum of infant malnutrition includes many combinations of wasting, hepatomegaly,

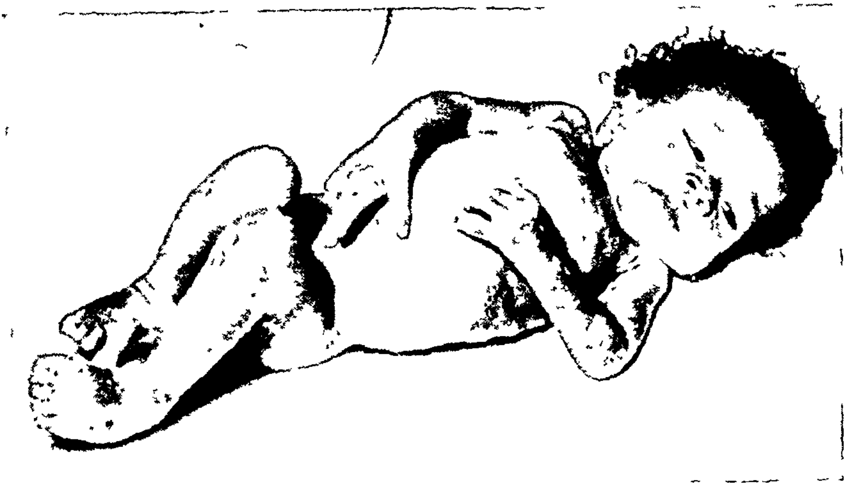

Fig 3

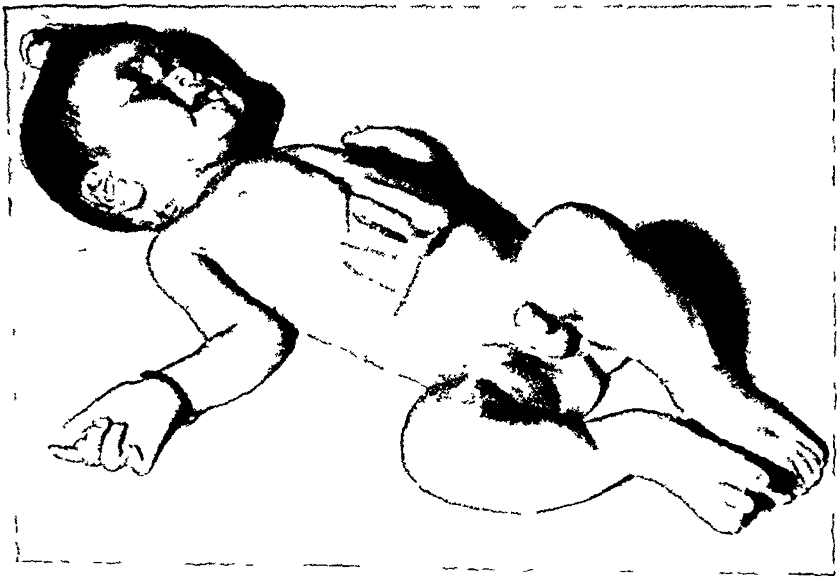

Fig. 4

Fig. 3. Kwashiorkor in 6 month old infant, showing *oedema*, *flaky-paint* rash, growth failure and apathy.

Fig. 4. Kwashiorkor in 3 month old baby, showing oedema, hepatomegaly, apathy, "sugar-baby" excess, subcutaneous fat and *no* rash.

oedema and skin or hair change and, in those infants who are allowed to relapse, the pattern may alter between successive admissions.

After its frequency, the most remarkable finding was the restricted age incidence of malnutrition causing or contributing to death (Figs. 1 and 2). While 112 infant deaths were related to malnutrition, in older children only 18 deaths had a similar background, and, of these, all but two were in children who had been malnourished as infants, but had managed to survive for a month or two after the first birthday.

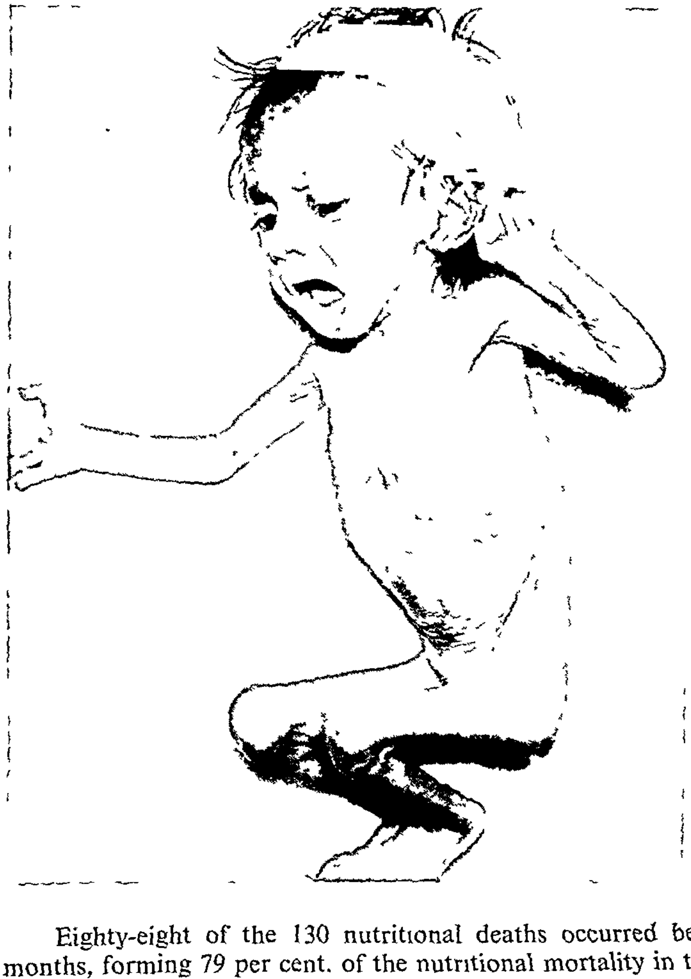

Fig. 5. Severe underfeeding (nutritional marasmus) in 5 month old baby, showing marked loss of subcutaneous fat and atrophy of muscles.

Eighty-eight of the 130 nutritional deaths occurred between the ages of 1 and 7 months, forming 79 per cent. of the nutritional mortality in the first year and 68 per cent. of that in the first 10 years. This is in marked contrast to the findings in less prosperous areas and appears to have a bearing on the origin of the problem and on its remedy.

RELATION TO INFANT FEEDING

The feeding history was seldom volunteered by the mothers, and direct questioning tended to produce polite agreement rather than accurate information, but it appeared that breast feeding had not been instituted, had ceased prematurely, or had been intermittent in those infants whose deaths were related to malnutrition.

As a substitute for breast milk, the infants had received small amounts of dried milk, often of a popular, expensive brand with a low protein content, or of condensed milk. On the few occasions when liquid milk was used, it, too, was given in high dilution. Precise information about the food intake was seldom available, but it was commonly claimed that a one pound tin of dried milk lasted as long as one month, a rate of consumption that would fail to provide an adequate protein intake even for an infant weighing three pounds. In most cases, the milk was eked out by mixture with arrowroot or sago, but sometimes, as the infant's condition deteriorated, glucose was added, apparently because of mystic virtues, associated probably with its high price. The common technique was summarised by the mother who said " I feeds the baby arrowroot, but whitens it with milk."

In addition, many infants received unknown quantities of various herbal infusions, given either as food or as medicine. The information available was inadequate to show whether these " bush-teas " were more widely used in malnourished infants than in other children, nor was it possible to associate a high carbohydrate intake with kwashiorkor rather than emaciation.

In many parts of Africa and Asia, infants generally thrive in the first months of life while they are breast fed, (JELLIFFE, 1955 ; GOPALAN, 1957), only to deteriorate when they are weaned on to a cereal diet of low protein content. In San Fernando, however, it seems that few children would die from malnutrition if an adequate diet could be ensured in the early months of life ; after the first year, economic circumstances and social customs combine to make grave malnutrition uncommon.

The surprisingly heavy incidence of nutritional deaths in the first semester is associated with failure to breast feed on the part of mothers who are not yet equipped educationally or financially to provide an adequate substitute and this trend appears to lie at the root of the problem of infant malnutrition in South Trinidad.

The causes of this failure to breast feed fall into three main groups, though it is uncommon in a given case to find that only one factor is operative. Maternal malnutrition, anaemia and toxaemia may lead to the birth of a premature infant from an ailing mother and the demands of the family and the shortage of hospital beds may lead to the mother's discharge early in the puerperium before breast feeding is established.

Widespread advertising and the presence of several varieties of dried milk in almost every grocery, and, perhaps, the reluctance of wealthier mothers to breast feed, give artificial feeding a prestige value similar to that observed elsewhere (NURGE, 1957). The high cost of the dried milk preparations in common use both adds to their status and diminishes the amount available to the infant. Associated with this is the existence in lay and even medical circles of indifference to, or ignorance of, the grave nutritional and infective hazards of bottle feeding under the unsatisfactory conditions which exist in many homes here.

Poverty may force the mother to abandon breast feeding in order to work and may be a cause of early failure of lactation, but it is relatively common to find an infant well-nourished despite his complete dependence on the breast of a woman emaciated by malnutrition and recurrent pregnancies.

The assessment of the relative importance of these and other factors in the abandonment of breast feeding requires sociological as well as medical study. The urgency of this need is increased by the fact that the trend appears to have developed during a period of rapid social change and may well be seen in the future on a vast scale in other developing countries.

SUMMARY

Over a two year period, of 294 children dying from medical or infectious diseases in a general hospital, 94 per cent. had an autopsy performed. One hundred and sixty three of the children were aged between 1 month and 1 year and in these, malnutrition was the sole cause of death in 33 per cent., and a major contributory factor in 36 per cent. In contrast to the findings elsewhere, malnutrition was most common between the ages of 1 and 7 months, which period accounted for 79 per cent. of tne nutritional mortality in the first year and 68 per cent. of that in the first 10 years. Possible reasons for this early incidence are discussed briefly.

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EXCERPTS

PORTAL VENOGRAPHY : WITH REFERENCE TO VENO-OCCLUSIVE DISEASE IN BANTU CHILDREN

(STEIN, L. *Medic Proc.* (Cape Town), 1958, 4, 31)

Veno-occlusive disease of the liver has now been reported as occurring in Bantu children in Johannesburg, South Africa. The present paper describes visualization of the venous occlusion radiologically, using percutaneous trans-splenic portal venography.

HEPATOC VENO-OCCLUSIVE DISEASE PRODUCED EXPERIMENTALLY IN RATS BY THE INJECTION OF MONOCROTALINE

(HILL, K. R., STEPHENSON, C. F. AND FILSHIE, I. *Lancet*, 1958, i, 623)

This preliminary note describes the development of the pathological picture of veno-occlusive disease of the liver in experimental rats following the intraperitoneal injection of monocrotaline, one of the alkaloids isolated from several species of Crotalaria.

BOOK REVIEWS

Patterns of Mothering. By S. Brody. 1956. New York : International Universities Press, Inc., pp. 446. $7.50 (approx. £3).

There is at present a desirable trend towards a cross-cultural approach to many problems of child health, and this book is based partly on this type of consideration. Thus, the first section is devoted to an interesting account of different patterns of maternal behaviour to her infant in different cultures. These especially include attitudes towards breast feeding, methods of weaning, whether a permissive or authoritarian attitude, towards the child is customary, and so on. The second half of the book describes a research study conducted by the author on the behaviour of thirty-two mothers of infants in the first half year of life. The resultant case histories are of considerable interest.

It is to be hoped that those working in different cultural areas of the world may attempt to investigate the " pattern of mothering " found locally, and its effect upon the young infant.

Juvenile Epilepsy. Report by a Study Group. 1957. Geneva : WHO Technical Report Series No. 130. pp. 44. 1/9. $0.30.

This Report discusses many of the problems associated with juvenile epilepsy, but gives especial emphasis to public health aspects, including the organization of medical and social guidance for the epileptic child, case finding and supervision, and the social handling of cases. Although it has a lesser priority as a pediatric problem in most tropical countries, as compared with malnutrition, infections, diarrhoea and parasitic infestation, there is every reason to believe that juvenile epilepsy occurs equally commonly all over the world. This booklet is then of real value in presenting an up-to-date account by a group of world experts of the solved and unsolved problems in this field.

The Future of the Arid Lands. Edited by G. F. White. 1956. New York : American Association for the Advancement of Science. pp. 453. $6.75 (£2-8-0d.).

As malnutrition is the most important child health problem in the tropics, this account is of great interest in that it is concerned with the possibility of future agricultural development of the at present unproductive arid areas of the globe. Experts in various different specialties have collaborated in its production. The problems are discussed initially from a biological view-point, by analyzing how plants, animals and certain human groups have adapted themselves to the intensely hot, dry climates of desert regions. Future possibilities are considered, including improved methods of irrigation and the use of seawater. The need for research is especially stressed, particularly in the field of " physiological genetics " with a view to developing suitably resistant strains of food plants.

New Frontiers in Child Guidance. Edited by A. H. Esman. 1958. New York : International Union Press Inc. pp. 218. $4 (£1-8-0d.).

This publication consists of nine contributions by psychologists on their work in the field of child guidance in New York. All are of the psycho-analytical school and their writings reflect this approach. The subjects vary considerably, but most are of considerable practical relevance, such as one on the interpretation of psychological tests findings to parents and another on nursery group experience as a diagnostic procedure for pre-school children. All in all, this book can be recommended for experienced child psychologists, although whether its findings have as much relevance to the problems of child guidance in other cultures is entirely speculative.

Behavioral Goals of General Education in High School. Edited by W. French. 1957. New York : Russell Sage Foundation. pp. 247. $4 (£1-8-0d.).

The theme of this book is one that is important in all parts of the world. Basically its argument is that schools should teach not only formal text-book knowledge, but also should impart " education for life." The possibilities of this phrase cover, in the opinion of the author, a very wide range, including ability to communicate ideas, the use of logical thinking, the improvement of control of both physical and emotional self, and especially the ability to maintain relationships with the small and large groups in which a person finds himself in the particular community.

This type of attitude towards the purpose of schooling is especially significant to most tropical children in the field of health education, as it has become increasingly apparent that one of the best places to attempt to modify health habits is the school.

Although not all the listed " behavioral outcomes " of schooling are of universal application, this publication is of great value to the tropical child health worker in that it stresses the fact that schooling implies much more than the acquisition of technical knowledge, important though this may be.

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The Journal of TROPICAL PEDIATRICS

VOL. 4. No. 3. DECEMBER, 1958.

EDITORIAL

ANIMAL DISEASE AND TROPICAL CHILDREN

Man has always lived in very close contact with his domestic animals, and this is certainly very much the case in rural tropical regions nowadays.

The possibility of the spill-over of certain animal diseases to human beings is well-known, and especially liable to occur in children. Many infections spread in this way have long been recognized and include rabies, echinococcosis and salmonellosis.

In addition, however, several relatively newly described entities may be important in some tropical localities. One such is the syndrome of pyrexia and localized lymphadenopathy due to cat scratch disease (WENTWORTH, 1958) and, although little information is available, it seems highly likely that this must occur in the tropics, but is not recognised in the flood of other more obvious and more easily clinically diagnosable conditions.

Leptospiral infection of animals is widespread, including such domesticated creatures as dogs, as well as rats and other rodents living in close contact with the dwelling places of man. The responsible bacteria are excreted, particularly in the urine, contaminate the ground and survive especially well in the moist warm soil conditions of humid equatorial tropical regions. Infection by skin penetration of children playing near the house must be common under these circumstances and it is again probable that some unexplained pyrexias may be caused by mild undiagnosed leptospiral infection (STEELE, 1958).

One of the most interesting chapters of human-animal epidemiology has been that recently reviewed by BEAVER (1958). In this, emphasis is given to the possibility of man, especially children, becoming infected with non-human parasites, which, while unable to complete their life-cycle, produce varying degrees of clinical reaction. The syndrome first to be described was that now known as visceral larva migrans, in which pyrexia hepatomegaly, a high eosinophilia and other features, are produced in children as a result of the wanderings in their bodies of larvae of the dog or cat roundworm (*Toxocara canis* or *T. cati*).

The probability of the existence of other similar syndromes is suggested by BEAVER, who feels that certain common signals should serve to alert the clinical or laboratory worker to the possibility of this type of situation. These include an eosinophilia of the blood, especially if high and sustained, liver enlargement, pneumonitis, bronchial asthma, urticaria and unexplained neurological incidents.

Certainly the tropical pediatrician should be on the alert for this type of clinical picture, and very probably a greater awareness of their existence will show that they play a not insignificant part in the pattern of childhood disease in tropical regions.

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CORRESPONDENCE

To the Editor

SIR,—We read with interest the paper of K. SAHAB and LIE KIAN JOE on the occurrence of *E. coli* types 0111:B4 and 055, in the June issue, 1958, Vol. 4, p. 28. In this paper, it is claimed that pathologic *E. coli* is rare in the tropics. They report, however, on the occurrence of around 10 per cent. in their material. We would like to inform you that similar examinations were done in the Philippines by us and P. ARAGON in the Philippine General Hospital and by GUERRERO and co-workers in the Santo Tomas University Hospital and in the San Lazaro Hospital.

The respective papers were read at the annual convention of the Philippine Medical Association in May, 1958, and are now in the press. GUERRERO et al. found 26 per cent. positive cases for pathogenic *E. coli* in the University of Santo Tomas Hospital, and 40 per cent. in the San Lazaro Hospital. They were able to isolate six different types of pathogenic *E. coli*. Since we do not have the manuscript, we cannot go into the details. We would like to emphasize that according to these papers, *E. coli* is rather frequent in the Philippines.

We have ourselves examined 500 infants suffering from diarrhoea, using rectal swabs for culture. Out of these cases, 102 were found to have pathogenic strains of bacteria, 60 with *E. coli*, 40 with Shigella and Salmonella, and 2 with both *E. coli* and Shigella. In our material, 4.4 per cent. of cases with diarrhoea exhibited pathogenic *E. coli*. The higher percentage of GUERRERO et al. is due to the fact that they made several examinations while we did only one, and then proceeded to treat the patient.

As we had only four typing sera, we were able to isolate only four serotypes. For further details, we refer to the papers which will be published soon. At any rate, it can be seen that pathogenic *E. coli* may be as frequent in the tropics as in the temperate climate and, while 0111:B4 and 055:B5 are the most frequently found types, it can be stated that other types are likewise to be found.

EUGENE STRANSKY and P. DIZON-SANTOS-OCAMPO.

General Hospital, Manila.

STUDIES ON LACTATION IN POOR INDIAN COMMUNITIES*

by

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In poor Indian communities, women invariably breast-feed their infants for prolonged periods. Studies of various aspects of lactation may, therefore, throw considerable light on the problem of maternal and infant nutrition in these communities. The important questions in this connexion which need to be answered are the following : for how long, and to what extent, does breast milk contribute to the nutrition of the infant? Is it possible to improve the quality and yield of breast milk of malnourished mothers by improving their diets? What are the effects of continued lactation on the nutritional status of the mothers? In this communication, the results of investigations of these aspects of lactation are briefly presented. Some aspects of these studies are being reported in greater detail elsewhere. The subjects investigated belonged to the poor socio-economic sections of the population.

(I) THE OUTPUT OF BREAST MILK AT DIFFERENT STAGES OF LACTATION

The object of this study was to elucidate the pattern of the 24 hour milk yield of the mothers throughout the lactation period. In the communities investigated, the mothers breast-fed their infants for nearly 2 years. The question has often been asked whether such continued lactation has any real nutritional significance for the infant. Information on the 24 hour milk yield throughout the lactation period can be gathered by two methods: (1) cross-sectional determination of the 24 hour output of breast milk at a given time, of a large series of mothers in different stages of lactation; (2) serial determinations of the 24 hour output of breast milk in individual mothers throughout the period of lactation. Both these methods have been used. The second approach, despite practical difficulties, has the advantage of enabling a simultaneous study of the growth of the infant. Its results are reviewed here.

Experimental : The subjects selected for this study were fourteen mothers belonging to the poor socio-economic group and their infants. The ages of the mothers ranged from 20 to 30 years; of these, five were primiparae. The investigation was begun immediately after the infants were born. The diets of the mothers consisted mostly of cereal gruel, the cereal being either *ragi* or rice, with occasional helpings of vegetables. Milk and flesh foods were rarely taken. The results of diet surveys of these mothers carried out by a carefully conducted oral questionnaire technique indicated that the total daily calorie intake ranged from 1500 to 1850 cal. and the protein intake from 27 to 50 g. These surveys were carried out between the 4th and 6th months of lactation. Careful enquiries also revealed that there were no appreciable variations in dietary intake in different stages

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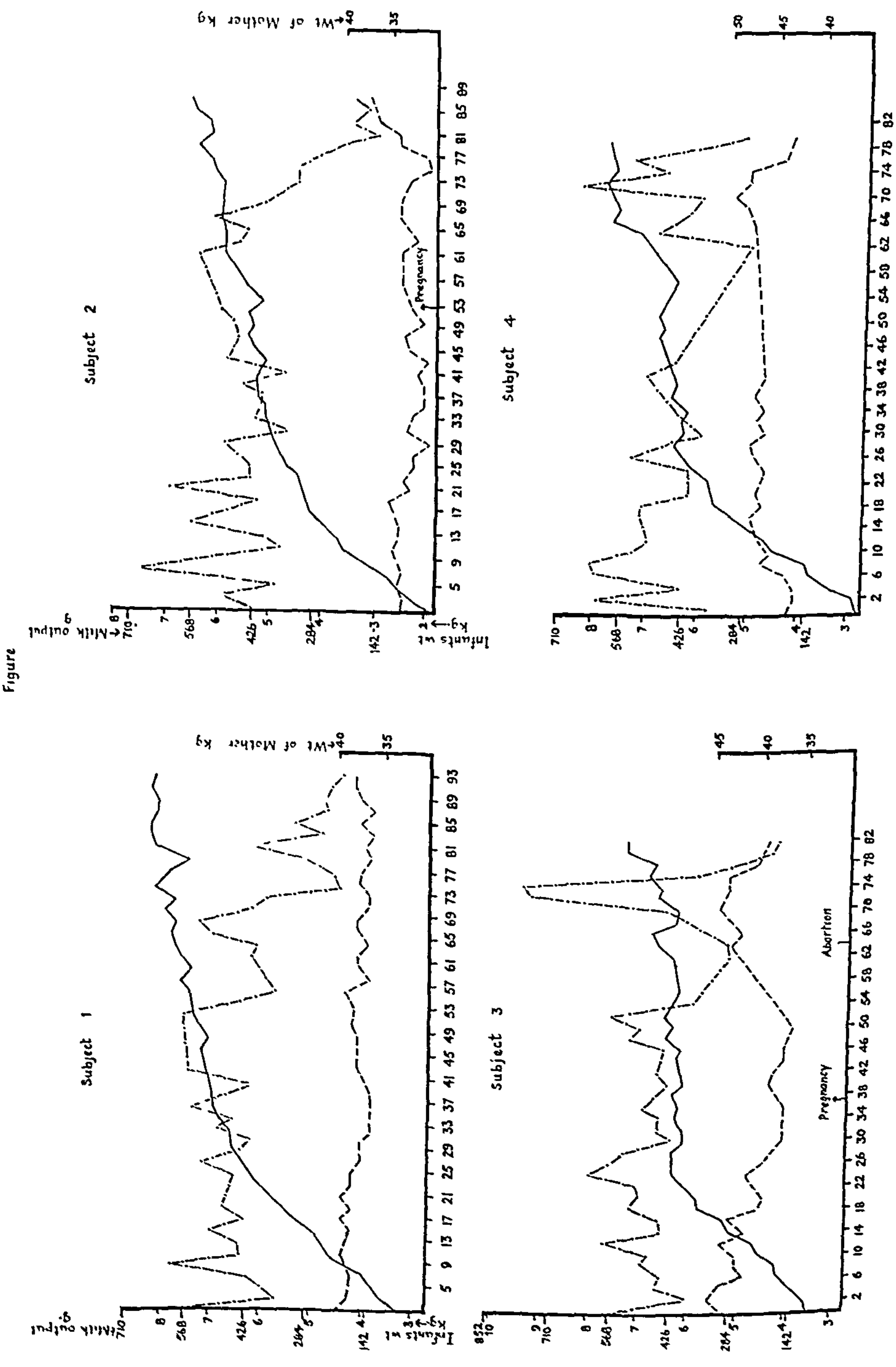

FIG. 1. Serial observations on six lactating women.

of lactation in the same mothers. The amounts of breast milk taken by the infants in 24 hours were determined at weekly intervals for the first 4 weeks and fortnightly thereafter. In eight of the mothers, the study was terminated after 6 months. In the remaining six, the study was continued for 90 to 100 weeks. To determine the amounts of milk taken by the infants in 24 hours, the mothers and infants were admitted to hospital and the infants were accurately weighed on a sensitive lever-type balance before and after each feed during the 24 hours. To gather information as to the quality of milk in the later stages of lactation, samples of milk obtained by manual expression between the 71st and 100th weeks of lactation from the six mothers, were analysed for proximate principles, vitamins and minerals. Since similar data for the same mothers were not available for the earlier stages of lactation, these values have been compared with those obtained in a series of mothers of the same socio-economic group between the 4th and 24th weeks of lactation by using identical sampling and chemical procedures. The details of the procedure employed in sampling of the milk and of the chemical estimations will be reported separately.

Throughout the period of study, the mothers were feeding their infants on demand. During the first 6 months, the infants were fed solely on the breast; thereafter they received supplementary feeds mostly of rice gruel. Precise information regarding these supplementary feeds in each of the six infants was gathered through careful questioning at the 32nd week and again at 64th week.

Results : The results of the study are presented in Table I and II and in Fig. 1. The observations on milk yield till the end of 6 months and the growth of the infants during

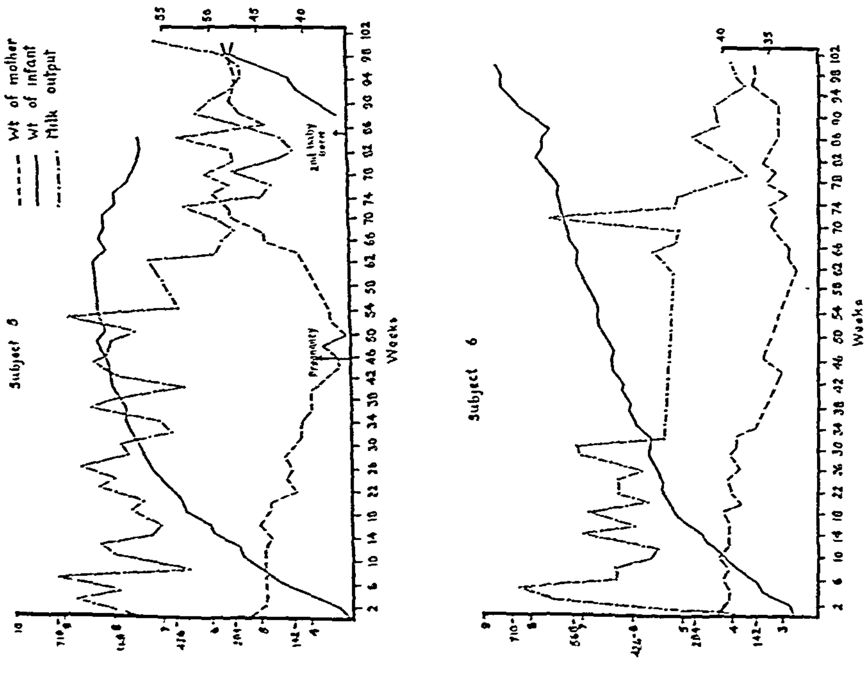

FIG. 1. (*continued*).

this period, in fourteen mothers have been discussed in an earlier communication (GOPALAN, 1956). The observations regarding each of the six mothers and infants studied for 90 to 100 weeks are commented upon below.

Subject 1. Mother, aged 30 years, 3rd child. The 24 hour milk output was maintained between 400 and 600 g. up to the end of one year and began to decline only thereafter. Even around the 93rd weeks of lactation, between 200 and 250 g. of milk was being secreted in 24 hours. The protein content

TABLE I. Mean values for output of breast milk by fourteen Indian women in different stages of lactation.

Weeks of lactation	1	2	3	4	6	10	12	14	16	18	20	22	24
Mean weight of infant (g.)	2,778	2,920	3,119	3,260	3,714	4,196	4,394	4,564	4,820	5,103	5,338	5,557	5,755
Mean milk output in 24 h. (g)	454	476	479	496	499	473	471	516	527	513	454	505	516

TABLE II. Chemical composition of the milk of six Indian mothers in the late stages of lactation.

Subject No.	Week of lactation	Fat (g.%)	Protein (g./100 ml.)	Lactose (g.%)	Calcium (mg.%)	Phosphorus (mg.%)	Vitamin A (i.u./100 ml.)	Thiamine (µg./100 ml.)	Riboflavin (µg./100 ml.)	Ascorbic acid (mg./100 ml.)
1	66	4 99	0.90	7.54	23.0	12.0	104	5.6	27.6	2.5
	73	3.49	0.74	7.92	18.6	10.9	68	—	—	0.9
	83	5.16	0.92	7.46	25.9	12.7	90	14.6	22.8	1.5
	93	—	0.98	—	24.4	13.2	—	18.8	—	2.0
2	71	5.74	1.10	4.97	27.5	6.0	57	0.7	33.3	3.0
	78	4.98	1.27	7.76	40.6	14.0	—	—	—	2.4
	83	—	2.70	—	—	—	—	—	—	2.0
3	71	—	0.62	—	—	—	—	—	—	4.0
	80	—	0.22	—	54.2	7.8	—	—	—	1.1
4	71	3.25	0.91	7.08	34.2	19.4	72	19.7	20.0	1.6
5	71	—	3.96	—	—	—	—	—	—	3.3
	80	—	4.58	—	—	—	—	—	—	1.0
	87	5.92	1.71	7.21	59.5	10.8	109	—	3.7	2.1
	90	4.85	1.35	7.13	37.4	16.1	68	13.0	21.0	2.7
	100	1.83	1.28	7.19	38.4	13.9	26	15.6	14.3	3.3
6	71	6.56	1.08	6.67	56.7	19.8	96	18.7	20.0	2.4
	100	—	1.29	—	22.0	12.3	—	14.4	—	7.9
Mean value with its standard error for forty mothers of similar economic status between the 4th and 24th weeks of lactation		3.34	1.06	7.47	36.3	11.7	79	15.3	19.0	1.9
S.E.		±0.242	±0.036	±0.072	± 1.96	± 0.46	± 7.1	± 0.96	± 1.59	± 0.188

of milk in the later stages of lactation was slightly lower than the average value observed in similar women in the earlier stages of lactation. The mother's weight remained almost stationary between 40 and 45 kg. throughout the period of study. The infant doubled its weight by about the 26th week. By the criterion of time taken for doubling of birth weight, the growth rate of the infant in the first 6 months when it was solely breast fed, may be considered quite satisfactory. After the 6th month, the infant's growth rate fell off.

Subject 2. Mother, aged 18 years, first para. The 24 hour output of breast milk was maintained between 450 and 600 g. till about the end of the 1st year, when the woman became pregnant again. There was a sharp decline in the output of milk after the 12th week of pregnancy and by about the 32nd week the output had fallen to about 150 g. Scrutiny of Table II reveals that this fall in the output of milk was associated with a marked increase in protein content, which in the 83rd week of lactation (32nd week of subsequent pregnancy) was as high as 2.7 g./100 ml. The growth rate of the infant, by the same criterion as for Subject 1, was apparently satisfactory till about the 6th month. The growth rate of the infant, even after the onset of pregnancy of the mother and subsequent sharp decline in breast milk output, was not as unsatisfactory as in Subjects 3 and 5 described below, who had also become pregnant during the course of study.

Another important feature about this subject was that with the onset of pregnancy the mother failed to show the increase in body weight which might be expected of normal well-nourished pregnant women.

Subject 3. Mother aged 26 years, sixth para. The 24 hour output of breast milk was maintained between 450 and 600 g. till about the 50th week of lactation. Around the 36th week, the patient became pregnant again, but aborted after 28 weeks (64th week of lactation). From the 14th week of the new pregnancy, the output of milk fell progressively till the time of abortion. Immediately after the abortion, there was an abrupt increase in the output of milk which, however, was not sustained. By the 80th week of lactation the output had dropped to about 150 g.

The growth of the infant was apparently satisfactory till about the 24th week, but thereafter there was a striking retardation which was probably due to the low protein content of the milk, which was 0.62 g./100 ml. at the 71st week and 0.22 g./100 ml. at the 80th week. The infant developed hypoproteinaemic oedema and other frank signs of kwashiorkor when the mother was in her 60th week of lactation. The child was admitted to the hospital and successfully treated on the usual lines.

The mother's weight showed a progressive drop with continued lactation; but the onset of pregnancy arrested it and the weight tended to increase till the time of abortion after which it again decreased.

Subject 4. Mother, aged 25 years, fourth para. The features were nearly similar to those of Subject 1, with regard to the pattern of milk output and behaviour of weight of infant and mother.

Subject 5. Mother, aged 29 years, fifth pregnancy. The 24 hour milk output ranged between 450 and 650 g. till about the end of the first year. Thereafter there was a progressive decline in the milk output. The patient had again become pregnant in the 46th week of study. Her lactation remained at the pre-pregnancy level for about 8 weeks and thereafter declined rapidly. The interesting feature was that up to the time of delivery in the 85th week of study, the mother was feeding her infant. On the eve of delivery she was secreting about 150 g. of milk. With the birth of the new baby the milk yield rose again.

The protein content of the milk showed interesting fluctuations. At the 71st week of study (25th week of pregnancy), the protein content was 3.96 g./100 ml., and at the 80th week (34th week of pregnancy), as high as 4.58 g./100 ml. In the 87th week of study (3 weeks after delivery) the protein content had dropped to 1.71 g./100 ml., and in the 100th week (16th week after delivery) to 1.28 g./100 ml. Thus, as in Case 2, the progressive decline in output of milk after the 12th week of pregnancy seemed to be associated with a progressive increase in the protein content of milk.

The growth rate of the infant was again apparently satisfactory till about the sixth month; thereafter there was marked retardation of growth and indeed in the final stages of the study the infant was actually losing weight. The possible explanation is that after the sixth month, though the mother claimed that she was giving the infant supplementary feeds, these were highly inadequate. The mother was engaged in manual labour to earn her livelihood. With the advance of pregnancy and her consequent inability to work, even this inadequate supplementary feeding became impossible in the final stages of pregnancy. The position of the mother in this regard was different from that of Subject 2 who though belonging to the same socio-economic class did not have to work for her living.

The weight of the mother showed a progressive decline with contined lactation but this decline was arrested with the onset of pregnancy after which there was a progressive increase in weight till the termination of pregnancy.

Subject 6. Mother, aged 25 years, third para. The 24 hour milk output tended to decline after about the 70th week. The mother's weight decreased progressively till about the 70th week, but thereafter tended to rise slightly, probably as a result of the fall in the milk output after this period. The growth rate of the infant was probably the best in the whole series even after the 6th month, probably because of the relatively high protein content of the milk even in the late stages of lactation. The protein content of the milk at the 71st and 100th week of lactation (1.13 g. per cent.) was even higher than the mean value observed in the earlier stages of lactation (1.06 g. per cent.).

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TABLE II Chemical composition of the milk of six Indian mothers in the late stages of lactation

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1	66	4 99	0 90	7 54	23 0	12 0	104	5 6	27 6	2 5
	73	3 49	0 74	7 92	18 6	10 9	68	—	—	0 9
	83	5 16	0 92	7 46	25 9	12 7	90	14 6	22 8	1 5
	93	—	0 98	—	24 4	13 2	—	18 8	—	2 0
2	71	5 74	1 10	4 97	27 5	6 0	57	0 7	33 3	3 0
	78	4 98	1 27	7 76	40 6	14 0	—	—	—	2 4
	83	—	2 70	—	—	—	—	—	—	2 0
3	71	—	0 62	—	—	—	—	—	—	4 0
	80	—	0 22	—	54 2	7 8	—	—	—	1 1
4	71	3 25	0 91	7 08	34 2	19 4	72	19 7	20 0	1 6
5	71	—	3 96	—	—	—	—	—	—	3 3
	80	—	4 58	—	—	—	—	—	—	1 0
	87	5 92	1 71	7 21	59 5	10 8	109	—	3 7	2 1
	90	4 85	1 35	7 13	37 4	16 1	68	13 0	21 0	2 7
	100	1 83	1 28	7 19	38 4	13 9	26	15 6	14 3	3 3
6	71	6 56	1 08	6 67	56 7	19 8	96	18 7	20 0	2 4
	100	—	1 29	—	22 0	12 3	—	14 4	—	7 9
Mean value with its standard error for forty mothers of similar economic status between the 4th and 24th weeks of lactation		3 34	1 06	7 47	36 3	11 7	79	15 3	19 0	1 9
S E		±0 242	±0 036	±0 072	± 1 96	± 0 46	± 7 1	± 0 96	± 1 59	± 0 188

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DISCUSSION

In these poor communities women are almost in a state of continuous lactation throughout the child bearing period of their lives, as exemplified by Subject 5. The implications of this from the point of view of the health and nutritional status of the mother have to be carefully considered. The mothers secrete between 450 and 600 g. of milk in 24 hours till about the end of the 1st year; even around the 100th week of lactation the milk output is around 150 g. The protein content of milk tended to decline slightly in the later stages of lactation. About 12 weeks after the onset of another pregnancy, there was a sharp decline in the output of milk, but this was associated with a remarkable rise in the protein content. These fluctuations in protein content were not related to fluctuations in fat content of the samples examined and were evident even when the values were expressed on fat-free basis.

A scrutiny of the weights of the children reveals that till the end of the first 6 months, though the actual body weights were lower than those reported at the 50th percentile for American infants of corresponding ages, the growth rates were not unsatisfactory, as judged by the criterion of time taken for the infant to double his birth weight. After the 6th month, however, growth was observed to become progressively more inadequate. It is obvious that breast milk alone will not be able to sustain growth at an adequate level beyond about 20 weeks. In the present study, all the infants received such supplementary feeds after the 26th month as the mothers could afford; the actual nature and amounts of such supplementary feeds were assessed by careful questioning. It was estimated that between the 6th month and the end of first year, breast milk contibuted about 60 per cent. of the infant's total protein intake, and between the 12th month to the end of 18 months about 35 per cent. Considering that the protein derived from supplementary feeds was almost all from cereal, it will be apparent that even up to the 18th month, breast milk makes an important contribution to the total protein intake of the infants in these poor communities. It may be concluded then that the problem of protein malnutrition among children in these communities might be even more serious and extensive, but for this prolonged availability of breast milk for the infants.

(II) EFFECT OF DIETARY PROTEIN SUPPLEMENTATION OF LACTATION

Surveys of the diets of lactating mothers in poor Indian communities reveal general inadequacy. For example, in a group of poor mothers in different stages of lactation ranging from 1 week to 2 years after delivery, the calorie intake was estimated to range roughly between 1,400 and 2,400 cal., and the protein intake between 45 and 60 g. daily (PASRICHA, 1957). The question has to be considered whether improvement of this poor dietary would be reflected in an increased output of breast milk. This question has immense practical implications. If protein supplements given to the mother improve her lactation and thus improve the nutrition of the infant, it would be easier, more practical and rational, to achieve the nutritional improvement of the infants in this manner in the first few months after birth than through direct supplementary feeding to the infant.

Experimental : The investigation was carried out on the following two lines :

(1) Six mothers belong to the poor socio-economic class and in various stages of lactation (5-13 months) were admitted to the hospital. They were maintained for three successive 10-day periods on diets supplying 2,900 cal. and 61 g., 99 g. and 114 g. protein daily respectively. In the last 3 days of each 10-day period, test feeding was carried out

to determine the total amount of milk consumed by the infant in each 24 hour period. The infants were weighed in an accurate lever balance before and after every feed and the total amount of milk consumed in 24 hours was calculated. Samples of the milk obtained on these 3 days in each 10-day period were analysed for nitrogen. All samples were obtained by complete manual expression of both breasts at 10.00 a.m., 4 to 5 hours after the first feed of the day.

(2) Thirty mothers belonging to the poor socio-economic class were divided into two groups of fifteen each, of similar age, parity and occupational and environmental status. The mothers and their infants were selected for observation immediately after delivery. All mothers were allowed to live in their own homes, on their usual diets and following their usual activities. Diet surveys did not reveal any significant difference in intake of different nutrients between the two groups. Mothers of one group were given a daily supplement of 3 oz. skim milk powder supplying 30 g. protein. The milk was delivered at the homes and it was ensured that the skim milk was reconstituted and consumed by the mothers in the presence of the attending nurse. Mothers of the second group were given a placebo which consisted of calcium lactate 5 grams daily. All mothers were instructed to eat as usual; mothers of the group supplemented with skim-milk were specially advised not to eliminate any item of their usual food because of the supplement they were getting. Mothers and their infants were weighed on a sensitive lever balance once a fortnight. The investigation continued for 6 months after delivery, during which period it was ensured that none of the infants received any supplements and that all infants were solely breast-fed.

Results : The results of the first investigation are set out in Table III.

TABLE III. Milk yield and protein content of the milk of six Indian women at different levels of protein intake (mean values for three days measurements).

Subject No.	First period (61 g. protein)			Second period (99 g. protein)			Third period (114 g. protein)		
	Milk yield ml./24 h.	Protein content of milk g./100 ml.	Protein content of milk Total/ 24 h.	Milk yield ml./24 h.	Protein content of milk g./100 ml.	Protein content of milk Total/ 24 h.	Milk yield ml./24 h.	Protein content of milk g./100 ml.	Protein content of milk Total/ 24 h.
1	502	1.16	5.8	639	0.96	6.1	562	0.97	5.4
2	287	1.54	4.4	434	1.29	5.6	423	1.25	5.3
3	318	0.88	2.8	434	0.80	3.5	443	0.89	3.9
4	459	1.36	6.2	456	1.17	5.3	515	1.10	5.7
5	430	1.26	5.4	536	0.88	4.7	499	0.95	4.7
6	417	1.06	4.4	589	1.01	5.9	496	1.03	5.1
Mean	402.2	1.21	4.8	514.7	1.02	5.2	489.7	1.03	5.0

It will be seen that an increase in dietary protein from 61 g. to 99 g. daily resulted in an appreciable increase in the 24 hours output of breast milk in five of the six patients investigated. A further increase of protein intake to 114 g. daily had no further beneficial effect. It was noted, however, that the increase in the output of milk resulting from the increase of dietary protein from 61 g. to 99 g. daily was attended by a diminution in the percentage of protein in the milk with the result that the increase in total protein output

TABLE IV. Weight gains by breast-fed Indian infants whose mothers were eating their ordinary diet with or without a skim-milk supplement.

Group	Mean fortnightly increase (g.) in body-weight of infants for 6 months												
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	Total
Milk-supplemented (mean birth weight 2,736 g.)	386	403	380	397	326	346	292	235	241	184	204	147	3,541
Control (mean birth weight 2,892 g.)	318	400	386	363	284	281	255	258	309	193	201	164	3,412

in milk in the 24 hour period was not commensurate with the increase in the quantity of milk.

In the second investigation, a comparison of the growth of infants in the milk-supplemented and control groups (Table IV) did not reveal any striking differences.

DISCUSSION

The results have to be interpreted with caution. Firstly, most of the mothers investigated in this study had, even initially, a fairly satisfactory lactational performance. It may be physiologically impossible to improve significantly an already satisfactory performance, and for this reason, the beneficial effect of protein supplementation might have been masked. Secondly, the protein level in the dietaries of most of the mothers was of the order of 60 g. daily, an amount which, though well below the recommended allowance in lactation, is not as low as that observed among some of the poor communities. The conclusion that may be drawn is that in women subsisting on about 60 g. protein daily and having an output of breast milk of the order of 500 to 600 g. daily, protein supplementation has no striking beneficial effect so far as lactation is concerned. The possibility that protein supplementation may have an appreciable beneficial effect on lactation in women subsisting on very low levels of protein cannot be ruled out. It might be postulated from these results that the demands of lactation are so exacting that if the needed protein is not forthcoming from the diet, the maternal tissues are raided to meet the protein requirement. Under the circumstances, it might be expected that the effect of protein supplementation would not be reflected in an increase in milk yield but possibly in a correction of tissue protein deficit.

(III) NITROGEN-BALANCE STUDIES IN LACTATING WOMEN

It may be inferred from the studies reported above that the fairly satisfactory lactational performance of poor Indian women, despite their inadequate diets, is probably achieved through tissue depletion. In an attempt to elucidate this question, nitrogen-balance determinations on three levels of protein intake were carried out on a group of poor Indian women during lactation.

Experimental : The subjects of this study were the six apparently normal women in different stages of lactation (5 to 13 months) belonging to the low socio-economic group

TABLE V. Nitrogen balance in Indian mothers during lactation on three different levels of protein intake (mean values for three 24 h. collections).

Subject No.	First period (N intake = 9.81 g.)					Second period (N intake = 15.88 g.)					Third period (N intake = 18.09 g.)				
	Nitrogen excretion (g.)					Nitrogen excretion (g.)					Nitrogen excretion (g.)				
	In faeces	In urine	In milk	Total	Balance	In faeces	In urine	In milk	Total	Balance	In faeces	In urine	In milk	Total	Balance
1	3.75	4.56	0.89	9.20	+0.61	3.62	7.35	0.98	11.95	+3.93	4.29	8.36	0.90	13.55	+4.54
2	2.90	6.00	0.71	9.61	+0.20	5.41	7.85	0.96	14.22	+1.66	3.88	9.32	0.85	14.05	+4.04
3	4.10	5.01	0.46	9.57	+0.24	2.64	6.86	0.59	10.09	+5.79	3.79	7.90	0.63	12.32	+5.77
4	2.92	7.12	0.96	11.00	−1.19	4.73	7.05	0.85	12.63	+3.25	3.95	9.18	0.90	14.03	+4.06
5	3.79	4.87	0.80	9.46	+0.35	3.94	5.58	0.75	10.27	+5.61	4.91	7.49	0.76	13.16	+4.93
6	2.89	5.00	0.66	8.55	+1.26	3.06	7.70	0.95	11.71	+4.17	2.66	8.82	0.82	12.30	+5.79

who were used for the protein-intake trials illustrated in Table III. Nitrogen-balance studies on these mothers were carried out at three levels of protein intake — 61 g., 99 g. and 114 g. daily — but the daily calorie intake was kept constant at about 2,900 cal. throughout. Each study lasted 10 days. The first seven days of each 10-day period was allowed for the subjects to stabilize on the diet of the particular period. Urine and faeces were collected and the output of nitrogen in breast milk was assessed during the last three days of each period.

Results : The results are set out in Table V. It is seen that on an intake of 60 g. protein daily the subjects were nearly in nitrogen balance. However, when the protein intake was raised to about 100 g./day, a considerable positive nitrogen balance occurred in all the subjects. This positive balance was either maintained or slightly increased when the daily protein intake was raised to about 114 g. There was a linear relationship between nitrogen intake and nitrogen retention ($Y = 0.5363\ X - 0.1294$), and between N absorbed and N retained ($Y = 0.5805\ X - 0.0876$). In both, the regression coefficient was significant. From these graphs, it would appear that 0.24 g./nitrogen/kg. body-weight/day would be the minimum intake required for maintaining equilibrium in these subjects. This value is higher than that reported by PHANSALKAR and PATWARDHAN (1956) for an normal Indian male adult (0.087 g. M/kg. body-weight/day). Even on the basis of N absorption alone, faecal losses being neglected, these subjects required 0.15 g. N/kg. body-weight/day. It would appear that the protein requirement during lactation of these subjects is above 1.5 g./kg./body-weight/day.

DISCUSSION

It must be emphasised that the subjects studied here, though apparently healthy, were drawn from the poor groups of the population. They had gone through their pregnancies without any special improvement of their diets. It might be expected, therefore, that they all suffered from varying degrees of relative depletion of tissue protein. ALLISON (1949) has shown that in states of protein depletion, the minimum level of nitrogen needed to attain nitrogen balance is lowered. This would lead one to conclude that the minimum level of nitrogen needed to attain nitrogen balance in the subjects investigated here would have been even higher if their erstwhile protein nutritional status had been excellent. It would follow that the physiological requirement for protein in lactation is probably even higher than the level of 1.5 g. protein/kg. body-weight/day, arrived at in the present investigation.

In the present study it was found that nitrogen retention increased as the protein intake was raised. This might not be a specific attribute of the lactation state but could be the result of relative tissue-protein depletion of the subjects investigated. In computing the actual protein needs of the malnourished lactating women investigated here, it might be safe to consider the protein level which results in maximal nitrogen retention as the optimal requirement. On this basis, an intake of protein of 100 g. or above daily derived from the types of diet studied, is probably needed by these mothers to meet the increased demand of lactation and to overcome their tissue-protein deficit.

(IV) THE CHEMICAL COMPOSITION OF MILK

Some observations on protein and sulphur amino acids content in breast milk of poor Indian women had been reported by SRINIVASAN and RAMANATHAN (1953). An extensive study of the chemical composition of breast milk of poor Indian women is currently in progress. Some preliminary data based on the subjects so far investigated are presented in Table VI. No comment on these data can be attempted at this stage.

TABLE VI. Chemical composition of milk.

Constituent	Mean	Constituent	Mean
Total solids, g. %	12.07 (10.30-15.82)	Vitamin C, mg. %	2.0 (0.6-4.0)
Ash, g. %	0.18 (0.11-0.24)	Vitamin A, i.u./100 ml.	71.0 (30 to 118)
Protein, g. %	0.97 (0.74-1.27)	Vitamin B_1 r/100 ml.	
Fat, g. %	3.92 (1.80 to 7.48)	Vitamin B_2, r/%	21.0 (6 to 28)
Lactose, g. %	7.38	Sodium, mg. %	22.7 (5.7 to 38.6)
Calcium, mg. %	33.9 (16.9-54.2)	Potassium, mg. %	28.0 (4.8-44.7)
Phosphorus, mg. %	12.9 (7.8-19.8)	Magnesium	3.6 (0.8-8.4)

(V) ATTITUDES TOWARDS BREAST-FEEDING

Excellent opportunities for anthropological research into the problems of breast feeding exist in certain parts of India. The Todas, Irulas, Kurumbahs and Badagas of Nilgiri Hills (in which Coonoor is located) are tribes which continue to preserve their own distinctive cultures, traits and traditions, despite some " inroads " of modern civilization. The plantation labour and the urban labour in these hills have a somewhat different cultural pattern. The sophisticated intelligentsia of the high socio-economic group belonging to one extreme of the social scale are also represented. An extensive investigation of the attitudes towards breast feeding in these different cultural groups has been launched and the detailed results will be published separately. An important observation arising from this study may, however, be mentioned here.

There was an inverse relationship between the adequacy of lactation performance of a community and its position in the social scale. Among the highly educated women of the highest socio-economic group, it was found that over 80 per cent. were unable to breast feed their infants even up to six months after delivery. Among the lowest socio-economic classes, failure to breast-feed the infants for at least a period of six months was practically unknown. The reasons for this remarkable difference need not be discussed here. It became clear from the study that social and cultural factors and their psychological and emotional accompaniments were far more important determinants of lactation performance then dietary and nutritional factors; thereby supporting the results of an earlier small-scale investigation undertaken by JELLIFFEE (1956) in West Bengal.

The remarkable ability of poor women to breast feed their infants successfully over prolonged periods is one of the most gratifying features of the nutritional situation of Indian communities. This satisfactory situation with regard to lactation must be considered a valuable asset to be preserved and protected. The question has to be considered, however, from the point of view of the mother as well as the infant. It is obvious that the successful lactation of the poor mother is achieved at the expense of her tissues. Prolonged lactation can be considered permissible from the maternal point of view only if the improvement in maternal diet necessary to prevent the tissue protein deficit is possible. The basic problem, then, with regard to infant feeding in the poor communities is to ensure adequate improvement of the maternal diet so as to maintain lactation at the present level but without maternal protein depletion.

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EXCERPT

EXPERIENCE TECHNIQUE ET ADMINISTRATIVE DE FONCTIONNEMENT D'UN CENTRE DE REHYDRATION

(MENEGHELLO, J. et al. *Courrier*, 1958, 8, 377)

The authors describe the activities and methods employed in the Rehydration Centre of the Manuel Arriarán Hospital, Santiago, Chile. The efficiency, simplicity and excellent results obtained by rehydration by gastric catheter are emphasized, as is the fact that this method may be applied at various stages of treatment.

It is stressed that this type of rehydration centre can best be regarded as a make-shift arrangement assisting in dealing with a very large health problem, which cannot, however, be actually solved without an increase in hospital facilities for children and, above all, with steps to prevent this condition.

THE ERYTHROCYTE SEDIMENTATION RATE IN KWASHIORKOR (WITH AN ANALYSIS OF SOME OF THE BIOCHEMICAL AND HAEMATOLOGICAL FACTORS CONCERNED)

by

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An unusual feature of kwashiorkor is that the erythrocyte sedimentation rate is normal at the height of the illness and becomes abnormal as healing progresses (CATZEL et al., 1957). Our interest in this phenomenon was stimulated by the observation of GILLMAN and GILLMAN (1951) that the sedimentation rate was normal in a group of cases of kwashiorkor despite low serum protein levels, and despite the frequent presence of infection. As we had noticed several cases of this disorder with very high sedimentation rates, we decided to investigate this phenomenon serially. Since the completion of our studies our attention has been drawn to SUCKLING's recent M.D. Thesis (1955) in which he made serial E.S.R. studies in 50 cases of kwashiorkor and, like ourselves, noted that the E.S.R. was commonly normal on admission to hospital, but that it rapidly rose to abnormal levels with the institution of therapy.

It is the purpose of our paper to examine this phenomenon and to attempt to correlate these changes in the E.S.R. with the clinical, biochemical and haematological changes that occur simultaneously.

MATERIAL AND METHODS

Ninety Bantu infants suffering from kwashiorkor were studied. Of these, 47 were males and 43 females. About one third of the cases were nursed in an open ward and two-thirds in cubicles, over a period of 3-10 weeks. The criteria of selection as cases of kwashiorkor were those suggested by BROCK and AUTRET (1952). Blood was taken on admission to hospital and at weekly intervals thereafter. It is difficult to state precisely what the E.S.R. in a normal Bantu infant should be as, to our knowledge, no such survey has yet been done. In a previous paper (CATZEL et al., 1957), however, we showed that the serial changes in the sedimentation rate occurring during the treatment of kwashiorkor were significant whether we defined the "normal" E.S.R. as 0-10 mm. per hour *or* as 0-20 mm. per hour. We felt justified therefore in arbitrarily defining the uppermost limit of normal as 0-20 mm. per hour.

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The statistical analysis was performed in the Department of Statistics, National Physical Research Laboratory (C.S.I.R.), by Dr. H. S. Steyn and Mr. C. F. Crouse.

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The following tests were performed :

(1) *Erythrocyte sedimentation rate* (E.S.R.) using the Wintrobe (1951) technique. 1 ml. of oxalated blood was placed in a Wintrobe tube, which was then placed in a vertical rack at room temperature, allowed to stand for one hour and then read. No correction was made for anaemia for reasons to be discussed later. The reading is stated for convenience as "X mm. per hour" although strictly speaking it should read "X mm. *in the first* hour."

(2) *Packed cell volume* (P.C.V.). After the sedimentation test was done, the Wintrobe tube was placed in a centrifuge and spun at 3,000 r.p.m. for half an hour. The upper level of the red cells was then read and expressed as a percentage of the total column.

(3) *Red and white cell counts, and differential counts* using standard methods (WINTROBE, 1951).

(4) *Haemoglobin* determined as oxyhaemoglobin according to the method of KING et al. (1951).

(5) *Serum proteins.* Total serum protein and the various fractions were estimated by the method of WEICHSELBAUM (1946).

(6) *Serum cholesterol.* Total cholesterol estimations were performed after the method of ZAK et al. (1954).

On admission to the ward, the infants received a prophylactic injection of 2 cc. "Bicillin" (dibenzyl penicillin) and thereafter received sulphonamides or antibiotics only if indicated.

The majority of infants had diarrhoea on admission to the ward and received Hartmann's solution containing 5 per cent. dextrimaltose and potassium chloride during the first 12-18 hours. A small percentage required intravenous infusions for dehydration. Thereafter, feeding with undiluted skimmed milk containing 5 per cent. dextrimaltose was begun. With clinical improvement, usually during the second week, mixed feeding with porridge, meat and vegetables were given to the older infants. Vitamin supplements were not administered routinely.

RESULTS

A total of 416 sedimentation tests were performed over a period of 3-10 weeks on 90 infants suffering from kwashiorkor. These were graphically represented in Fig. 1, in which the E.S.R. was plotted against time in weeks and the average E.S.R. for each week was indicated by a heavy line. It was found that, on admission to the ward, the average E.S.R. was 12 mm. per hour and rose rapidly at the end of the first week to 35 mm. per hour to reach a peak of 47 mm. per hour on the 14th-21st day. Thereafter, it gradually fell to an average of 31 mm. per hour after the 7th week. On inspection of the figure, one observed a wide scatter in the E.S.R. readings, ranging from 1-75 mm. per hour, but if one separated the cases that had a normal E.S.R. (i.e., less than 20 mm. per

TABLE I. Distribution of normal and abnormal sedimentation tests in kwashiorkor during hospital stay.

E.S.R.	On admission	7th day	14th day	21st day	28th day	35th day	42nd day	74th day	Total determinations
Abnormal (> 20 mm./hour)	16 (18.6%)	51 (72.9%)	76 (92.7%)	68 (95.8%)	40 (88.9%)	19 (90.5%)	18 (100%)	21 (91.3%)	309
Normal (< 20 mm./hour)	70 (81.4%)	19 (27.1%)	6 (7.3%)	3 (4.2%)	5 (11.1%)	2 (9.5%)	0 (0%)	2 (8.7%)	107
Total	86 (100%)	70 (100%)	82 (100%)	71 (100%)	45 (100%)	21 (100%)	18 (100%)	23 (100%)	416

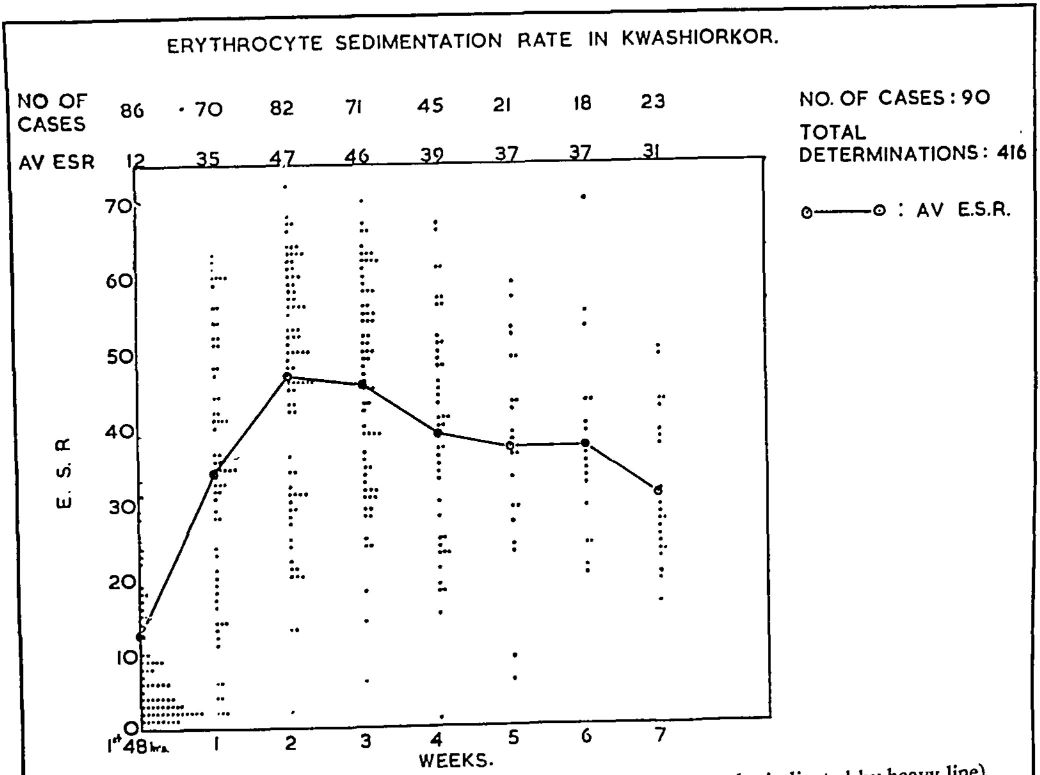

FIG. 1. Weekly E.S.R.'s in 90 cases of kwashiorkor. (Average results indicated by heavy line).

hour) from those with an abnormal E.S.R. (i.e., more than 20 mm. per hour), striking changes were noted (Table I).

On admission to hospital just over 80 per cent. of cases had a normal E.S.R., whereas within a week only 27 per cent. had a normal E.S.R. From the 14th day onwards, less than 10 per cent. of cases were normal. No difference in the sex incidence of normal and abnormal E.S.R.'s was found.

The frequencies obtained for sedimentation rates less than 20 mm. per hour and for those more than 20 mm. per hour were compared by using the χ^2 test and in all cases significant differences between the two sets of frequencies were obtained. The trend in these frequencies was clearly seen from the percentages.

(1) *Serum Cholesterol and E.S.R.* Serum cholesterol and E.S.R. estimations were done simultaneously in 225 instances. In Fig. 2, the average weekly cholesterol values were superimposed on that of the E.S.R. and it was found that there was a close parallel between the two. Statistically the correlation coefficient between the two sets of figures for each week was 0.861 which was highly significant (see Appendix). On admission the average cholesterol was 129 mg. per cent., on the 7th day it was 213 mg. per cent. and on the 14th day reached a maximum of 229 mg. per cent. despite the fact that these children were on low fat diets. Thereafter, it fell fairly steeply and from the 4th week onwards averaged between 170-180 mg. per cent. There was a wide scatter in the figures and

TABLE II. Number of normal and abnormal E.S.R. in different serum cholesterol ranges in kwashiorkor.

E.S.R. mm./hour	Serum cholesterol mg. %				Total
	<100	101-150	151-250	Over 250	
>20	4 (18.2%)	31 (59.6%)	91 (85%)	42 (89.4%)	168
<20	18 (81.8%)	21 (40.4%)	16 (15%)	5 (10.6%)	60
Total	22 (100%)	52 (100%)	107 (100%)	47 (100%)	228

they were broken down for convenience in Table II to illustrate certain trends. Each block represented the number of cases in which the E.S.R. and the serum cholesterol values corresponded, irrespective of the time when the tests were performed. Using the χ^2 test, these figures were statistically significant.

In 81.8 per cent. of instances where the serum cholesterol was less than 100 mg. per cent., the E.S.R. was normal. Inversely, in the majority of cases where the serum cholesterol was over 150 mg. per cent., the E.S.R. was abnormal. In other words, low cholesterol levels were usually associated with low E.S.R.'s while high cholesterol levels were associated with high E.S.R.'s.

(2) *Serum proteins and E.S.R.* Simultaneous E.S.R. and total protein determinations were performed in 304 instances ; albumin in 312, globulin in 294, alpha- and beta-globulin in 272 and gamma-globulin in 278 instances. (Fibrinogen determinations were not performed).

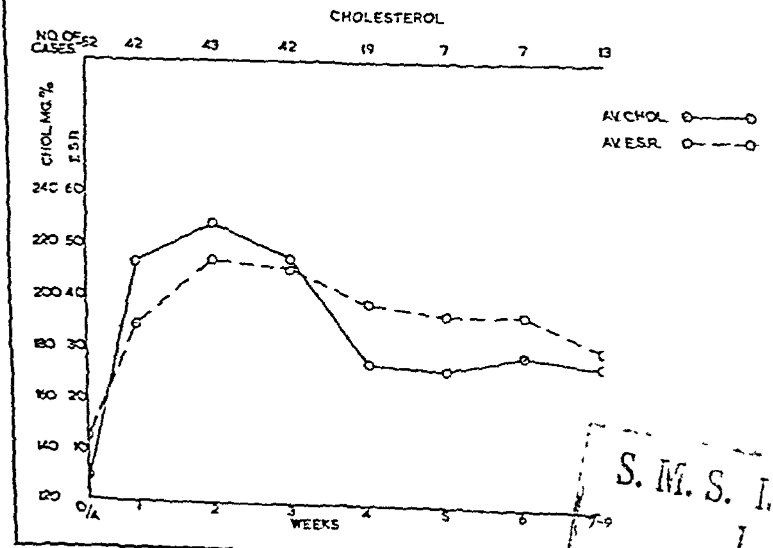

FIG. 2. Average weekly E.S.R.'s and serum cholesterols in 90 cases of kwashiorkor, showing parallelism between two.

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Fig. 3 illustrates the fairly rapid rise in all fractions chiefly in the first three weeks, and then more slowly thereafter.

The average weekly figures were superimposed on those for the E.S.R. and the parallel was not as close as was found in the case of cholesterol. It was noticeable that during the first six weeks, there was a reversal of the A:G ratio and it was only after the 7th week that the albumin reached higher levels than the globulin. The average sedimentation rate at this period it will be recalled (Fig. 1) was still abnormal, averaging 31 mm./hour (range 16-50 mm./hour), despite the fact that the majority of infections had, by this time,

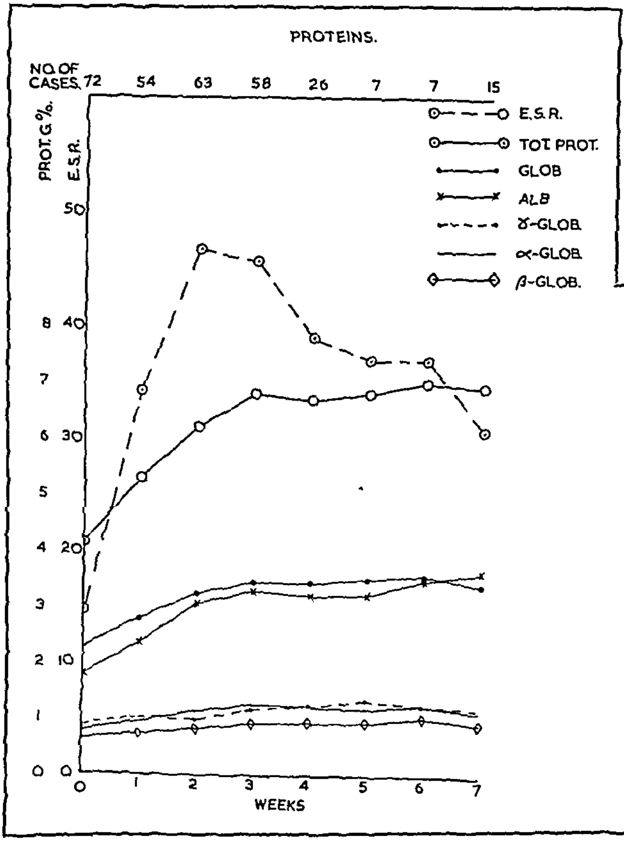

FIG. 3. E.S.R.'s and various protein determinations in 90 cases of kwashiorkor.

TABLE III.

E.S.R. mm./hr.	Total protein in g. %						Total No.
	4 g. %	4.0-4.9 g. %	5.0-5.9 g. %	6-6.9 g.%	7.0-7.5 g. %	7.6-8.9 g. %	
>20	7 (19.4%)	34 (48.5%)	34 (89.4%)	84 (94.3%)	49 (90.7%)	17 (100%)	225
<20	29 (80.6%)	36 (51.5%)	4 (10.6%)	5 (5.7%)	5 (9.3%)	0 (0%)	79
Total determinations	36 (100%)	70 (100%)	38 (100%)	89 (100%)	54 (100%)	17 (100%)	304

No. of normal and abnormal E.S.R.'s in various protein ranges.

been controlled by antibiotic therapy. Statistically it was found that there was a highly significant correlation coefficient between E.S.R. and serum globulin as well as between E.S.R. and gamma-globulin for each pair of points found at weekly intervals.

Less significant correlation was found between E.S.R. and total protein, albumin, beta- and gamma-globulin (see Appendix).

In Tables III(a)-(e) the number of normal and abnormal E.S.R.'s found in various serum protein ranges were analysed. As in the case of the cholesterol, it was found that

TABLE III(a).

E.S.R. mm./hr.	Serum albumin in g. %				Total
	0.9-1.5 g.%	1.6-2.5 g.%	2.6-3.5 g.%	3.6-4.6 g.%	
>20	9 (36%)	47 (46.6%)	120 (93.7%)	51 (87.9%)	227
<20	16 (64%)	54 (53.4%)	8 (6.3%)	7 (12.1%)	85
Total determinations	25 (100%)	101 (100%)	128 (100%)	58 (100%)	312

TABLE III(b).

E.S.R. mm./hour	Serum globulin in g. %				Total
	1.5-1.9 g.%	2.1-2.5 g.%	2.6-3.5 g.%	3.6 +	
>20	4 (16.6%)	22 (43.1%)	119 (80.9%)	69 (95.9%)	214
<20	20 (83.4%)	29 (56.9%)	28 (19.1)%	3 (4.1%)	80
Total determinations	24 (100%)	51 (100%)	147 (100%)	72 (100%)	294

TABLE III(c).

E.S.R. mm./hour	Alpha-globulin in g.%					Total
	0.4-0.5 g.%	0.5-0.75 g.%	0.76-1.0 g.%	1.1-1.4 g.%	1.5-2.25 g.%	
>20	0 (0%)	16 (43.3%)	63 (64.2%)	92 (86.8%)	25 (92.6%)	196
<20	4 (100%)	21 (56.7%)	35 (35.8%)	14 (13.2%)	2 (7.4%)	76
Total determinations	4 (100%)	37 (100%)	98 (100%)	106 (100%)	27 (100%)	272

TABLE III(d).

E.S.R. mm./hr.	Beta-globulin in g.%				Total
	0.5 g.%	0.5-1.0 g.%	1-1.5 g.%	1.5-1.8 g.%	
>20	12 (40%)	136 (72.3%)	45 (88.2%)	3 (100%)	196
<20	18 (60%)	52 (27.7%)	6 (11.8%)	0 (0%)	76
Total determinations	30 (100%)	188 (100%)	51 (100%)	3 (100%)	272

TABLE III(e).

E.S.R. mm./hr.	Gamma-globulin in g.%					Total
	0.5 g.%	0.5-0.75 g.%	0.76-1.0 g.%	1.1-1.5 g.%	1.6-2.8 g.%	
>20	1	18 (47.3%)	53 (56.2%)	98 (84.8%)	31+ (96.8%)	201
<20	0	20 (52.7%)	38 (43.8%)	18 (15.2%)	1 (3.2%)	77
Total determinations	1	38 (100%)	91 (100%)	116 (100%)	32 (100%)	278

the low serum protein ranges were usually associated with low E.S.R.'s and the high protein ranges with high E.S.R.'s irrespective of the time when the blood was taken. Using the χ^2 test, these figures were statistically significant.

(3) *Haematological Findings.* The patients were almost invariably anaemic on admission to hospital, the average haemoglobin being 10.2 gm. per cent. (range 6.7-13.0 gm. per cent.). During the first two weeks of treatment, the haemoglobin value fell still further to a minimum of 9.2 gm. per cent. (range 6.3-12.3 gm. per cent.) on the 14th day of treatment. This corresponded with the maximum average E.S.R. peak (Fig. 4), and the changes in the haemoglobin could be regarded roughly as a mirror image of that of the E.S.R. As the haemoglobin began to rise from the 3rd week onwards, the E.S.R. tended to fall. However, even after 6 or more weeks in hospital, the average haemoglobin was only 10.6 gm. per cent. (range 7.4-12.1 gm. per cent.) which was little more than on admission.

A similar " mirror image " was found in the case of the red blood cell count (R.B.C.) and the packed cell volume (P.C.V.) (Figs. 5 and 6).

The R.B.C., average 4,347,000/c.mm. on admission, reached a minimum of 3,760,000/c.mm. on the 14th day and gradually rose to almost its original level (4,337,000) after the 6th week. Similarly, the P.C.V. averaged 33.9 per cent. on admission, fell to 30.3 per cent. on the 14th day and then slowly rose to an average of 34.8 per cent. after the 6th week.

Both R.B.C. and P.C.V. rarely reached " normal " values in this series and considerable fluctuations were frequently present in individual cases from week to week.

The correlation test between averages for different weeks is to be found in the appendix. As the R.B.C. had a fairly high correlation with the E.S.R. it was also correlated with the weekly serum-cholesterol levels, and a highly significant negative correlation of − 0.836 (1 per cent. significant) was found.

Table IV represents the number of normal and abnormal E.S.R.'s in various P.C.V.

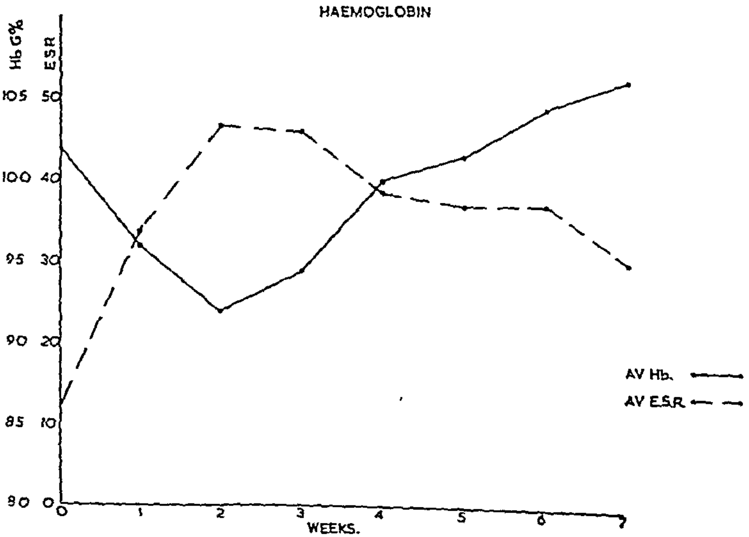

FIG. 4. Haemoglobin levels and E.S.R.'s in 90 cases of kwashiorkor.

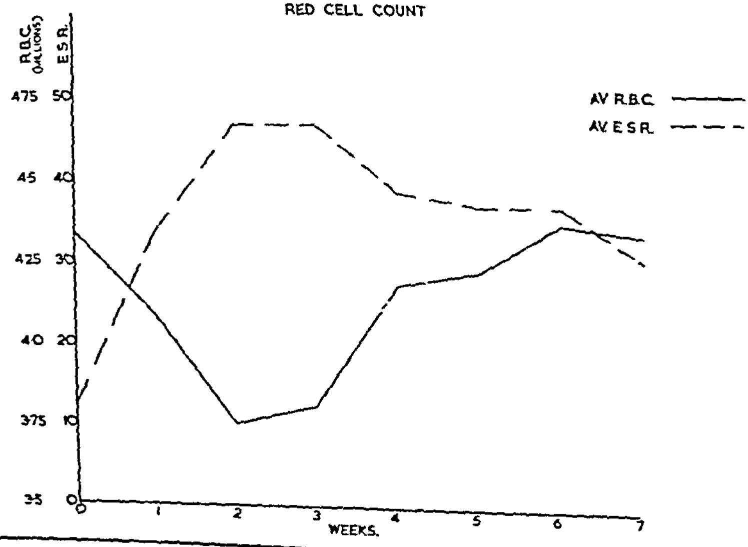

FIG. 5. Red cell counts and E.S.R.'s in 90 cases of kwashiorkor.

TABLE III(d).

E.S.R. mm./hr.	Beta-globulin in g.%				Total
	0.5 g.%	0.5-1.0 g.%	1-1.5 g.%	1.5-1.8 g.%	
>20	12 (40%)	136 (72.3%)	45 (88.2%)	3 (100%)	196
<20	18 (60%)	52 (27.7%)	6 (11.8%)	0 (0%)	76
Total determinations	30 (100%)	188 (100%)	51 (100%)	3 (100%)	272

TABLE III(e).

E.S.R. mm./hr.	Gamma-globulin in g.%					Total
	0.5 g.%	0.5-0.75 g.%	0.76-1.0 g.%	1.1-1.5 g.%	1.6-2.8 g.%	
>20	1	18 (47.3%)	53 (56.2%)	98 (84.8%)	31+ (96.8%)	201
<20	0	20 (52.7%)	38 (43.8%)	18 (15.2%)	1 (3.2%)	77
Total determinations	1	38 (100%)	91 (100%)	116 (100%)	32 (100%)	278

the low serum protein ranges were usually associated with low E.S.R.'s and the high protein ranges with high E.S.R.'s irrespective of the time when the blood was taken. Using the χ^2 test, these figures were statistically significant.

(3) *Haematological Findings.* The patients were almost invariably anaemic on admission to hospital, the average haemoglobin being 10.2 gm. per cent. (range 6.7-13.0 gm. per cent.). During the first two weeks of treatment, the haemoglobin value fell still further to a minimum of 9.2 gm. per cent. (range 6.3-12.3 gm. per cent.) on the 14th day of treatment. This corresponded with the maximum average E.S.R. peak (Fig. 4), and the changes in the haemoglobin could be regarded roughly as a mirror image of that of the E.S.R. As the haemoglobin began to rise from the 3rd week onwards, the E.S.R. tended to fall. However, even after 6 or more weeks in hospital, the average haemoglobin was only 10.6 gm. per cent. (range 7.4-12.1 gm. per cent.) which was little more than on admission.

A similar " mirror image " was found in the case of the red blood cell count (R.B.C.) and the packed cell volume (P.C.V.) (Figs. 5 and 6).

The R.B.C., average 4,347,000/c.mm. on admission, reached a minimum of 3,760,000/c.mm. on the 14th day and gradually rose to almost its original level (4,337,000) after the 6th week. Similarly, the P.C.V. averaged 33.9 per cent. on admission, fell to 30.3 per cent. on the 14th day and then slowly rose to an average of 34.8 per cent. after the 6th week.

Both R.B.C. and P.C.V. rarely reached " normal " values in this series and considerable fluctuations were frequently present in individual cases from week to week.

The correlation test between averages for different weeks is to be found in the appendix. As the R.B.C. had a fairly high correlation with the E.S.R. it was also correlated with the weekly serum-cholesterol levels, and a highly significant negative correlation of – 0.836 (1 per cent. significant) was found.

Table IV represents the number of normal and abnormal E.S.R.'s in various P.C.V.

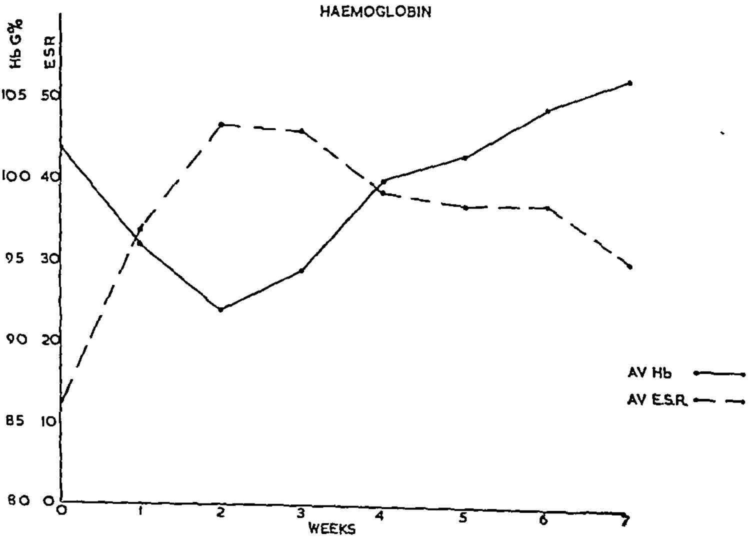

FIG. 4. Haemoglobin levels and E.S.R.'s in 90 cases of kwashiorkor.

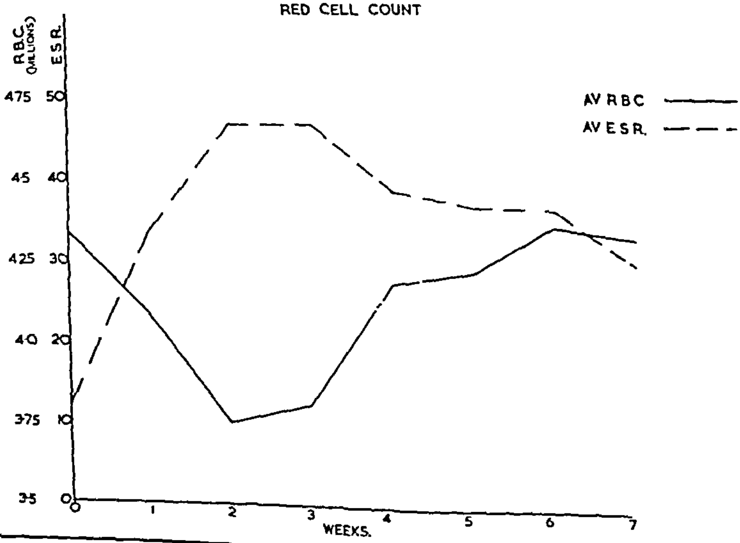

FIG. 5. Red cell counts and E.S.R.'s in 90 cases of kwashiorkor.

TABLE IV. Number of normal and abnormal E.S.R.'s in each range of P.C.V.

E.S.R. mm./hr.	P.C.V. ranges %				Total
	20-26%	27-32%	33-38%	39-46%	
>20	41 (97.6%)	114 (79.8%)	91 (60%)	3 (20%)	249
<20	1 (2.4%)	29 (20.2%)	60 (40%)	12 (80%)	102
Total determinations	42 (100%)	143 (100%)	151 (100%)	15 (100%)	351

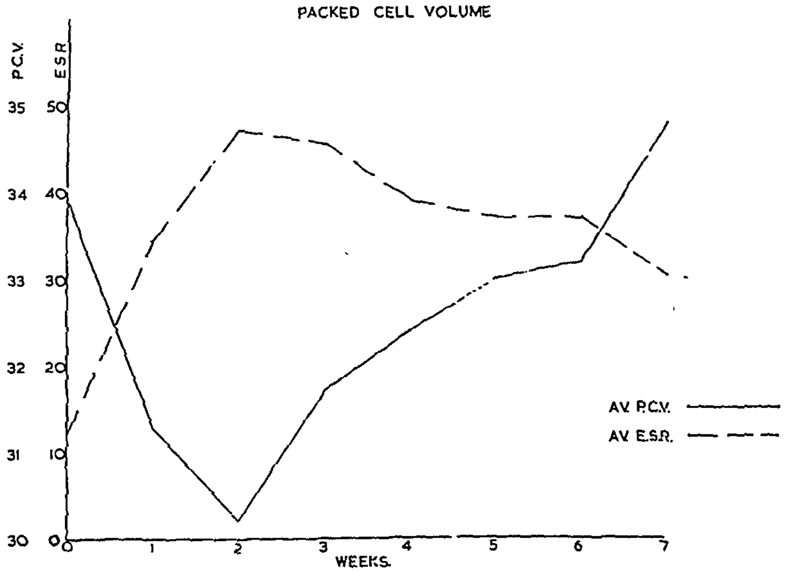

FIG. 6. Packed cell volumes and E.S.R.'s in 90 cases of kwashiorkor.

TABLE V. Number of normal and abnormal E.S.R.'s in each range of haemoglobin.

E.S.R. mm./hr.	Haemoglobin in g.%					Total
	6-7 g.%	7.1-8 g.%	8.1-10 g.%	10.1-12 g.%	Over 12 g.%	
>20	16 (100%)	33 (98.2%)	147 (81.3%)	96 (62.4%)	12 (34.3%)	304
<20	0	4 (10.8%)	34 (18.7%)	58 (37.6%)	23 (65.7%)	119
Total determinations	16 (100%)	37 (100%)	181 (100%)	154 (100%)	35 (100%)	423

ranges. It was found that high E.S.R.'s were commonly associated with low P.C.V.'s while low E.S.R.'s were commonly associated with higher P.C.V. values. Similarly, we found a similar relationship between E.S.R. and both haemoglobin (Table V) and R.B.C. counts.

DISCUSSION

It is known that widespread metabolic changes occur during recovery from kwashiorkor (SCRIMSHAW et al., 1957) and these changes often reach their peak by the end of the second week of therapy. In common with other workers in this field, we found that clinical improvement with return of the appetite, improved well-being, loss of oedema and healing of the skin and mucous membrane lesions was established by this time. It was unexpected therefore to find that the sedimentation rate of the blood was "normal" on admission to hospital in over 80 per cent. of cases yet, as healing progressed, the majority of sedimentation tests became abnormal. By the 14th day of treatment only 7.3 per cent. of tests could be regarded as normal. Even more unexpected was the close parallel between the changes in the sedimentation rate and some of the biochemical and haematological factors which we tested. These will be discussed in turn.

Statistically the closest parallel was found between the E.S.R. and the serum cholesterol. The role of serum cholesterol in influencing the sedimentation rate is uncertain. It is known that in uncomplicated idiopathic hypercholesterolaemia the sedimentation rate is normal and Dr. W. H. Davis, of the Department of Medicine of the Pretoria Hospital, has given me several instances where this was so. In experimental work, however, the results have been contradictory. FAHREUS (1929) noted that the addition of cholesterol to the blood increased the sedimentation rate. THEORELL (1930), however, noted the opposite effect. THYGESSEN (1942) stated that cholesterol had only a slight effect in increasing the E.S.R., while lecithin had a marked tendency to retard it. Our own finding of a close statistical correlation between the E.S.R. and the serum cholesterol levels does not necessarily imply a causative relationship between these two factors, as both may be dependent on some other factor or factors.

In clinical nephrosis a high sedimentation rate accompanies the acute phase of the illness and is associated with *hypo*albuminaemia and *hyper*cholesterolaemia. On the other hand in the acute phase of kwashiorkor a low E.S.R. is associated with *hypo*albuminaemia and *hypo*cholesterolaemia, an important differential diagnostic feature, provided that these blood examinations are done before treatment is begun. ROSENMAN et al. (1956) found in experimental nephrosis an inverse relationship between the serum albumin and serum cholesterol, but in kwashiorkor we found no correlation between these two factors.

There is general agreement that *in vitro* the addition of fibrinogen greatly increases the E.S.R., globulin does so to a lesser extent, while the addition of albumin retards the E.S.R. (FAHREUS, 1929). In clinical practise, however, there is not always a clear cut association between the height of the E.S.R. and the various protein fractions (LUCIA et al., 1936 ; ROPES et al., 1939 ; KOPP, 1942). In kwashiorkor we found a statistically significant correlation between E.S.R. and total protein, albumin, globulin, alpha-, beta- and gamma-globulin. The correlation between the E.S.R. and the alpha-globulin was as highly significant as that with cholesterol. As in the case of serum cholesterol, we also noted that the low serum protein and their fractions were commonly associated with low E.S.R.'s, while high protein values were associated with high E.S.R. values, confirming the week by week statistical correlation with the E.S.R. Unfortunately serum fibrinogen levels were not done in our cases. However, SUCKLING (1954) reported the finding of a good correlation between the E.S.R. and fibrinogen levels in 6 cases of kwashiorkor, the correlation being particularly high in cases with an associated tuberculosis.

Recently SCRIMSHAW et al. (1957) described the response to protein therapy in children with kwashiorkor in Guatemala. In addition to changes in the proteins and cholesterol similar to that which we have described, they also noted a rapid rise in the serum (as well as duodenal) enzymes amylase, esterase and lipase. The alkaline phosphatase, pseudocholinesterase and blood urea also rose rapidly, reaching their peak on the 10th day of treatment. The significance of these factors in relation to the E.S.R. is uncertain.

The possibility that changes in the blood volume influence the E.S.R. must be considered. It is known that if normal blood is diluted with plasma the E.S.R. rises proportionately to the degree of dilution. This method has been used as a basis of " correction for anaemia " charts such as those devised by WINTROBE (1951) and WHITBY and BRITTON (1944). In kwashiorkor tremendous changes in extra- and intracellular volume take place as evidenced by the rapid subsidence of oedema, the loss of 10-15 per cent. of body weight following diuresis, the marked changes in the haemoglobin content of the blood and the markedly lowered haematocrit. ALTMANN and MURRAY (1948) observed that during the early phase of recovery the haemoglobin, P.C.V. and R.B.C. dropped markedly, and suggested that this was due to the quick rise of plasma volume outstripping red cell regeneration. GOMEZ et al. (1955), by indirect measurement, found that in malnutrition there is an increase in both intra- and extracellular volume when measured in ml./kg. body weight. This group did not describe, however, what happened to the blood volume during treatment.

It seems possible that the sudden rise in the E.S.R. may be associated with the sudden dilution of the blood occurring at about this time. Indirect confirmatory evidence is the consistent fall in the haemoglobin, packed cell volume and red blood count during the early days of treatment, reaching its maximum fall at the time when the E.S.R. is at peak i.e., in the 2nd week. Thereafter, the haemoglobin, packed cell volume and red blood count tend to rise while the E.S.R. falls. It would be of interest to know whether similar changes occur in the plasma volume in nephrosis and other conditions associated with oedema and hypoalbuminaemia. In studying these cases the time factor seems to be most critical and a complete study must include *serial* determinations of haemoglobin, packed cell volume, red cell count and plasma volume.

In 1903, SCHLESINGER, quoted by GOMEZ et al. (1955), put forward the view that haemodilution could account for moderate degrees of hypochromic normocytic anaemia. GOMEZ et al. believe this to be the case in malnutrition and state that " wherever the decrease in haemoglobin and erythrocytes cannot be correlated with a concomitant increase in plasma volume, the presence of some other pathological process can be demonstrated." We believe that similar considerations apply to the E.S.R. and where the E.S.R. cannot be accounted for by plasma dilution then some other cause such as physical or biochemical disturbances must be looked for. In this connection it must be emphasized that most tables for " correction for anaemia " are based on the dilution of normal blood and the results of such dilution experiments cannot always be applied to abnormal blood. SMITH (1938) found that in a group of cases of nutritional anaemia in childhood with a low P.C.V., the E.S.R. was entirely normal. HAM (1938) has emphasized the fallability of correction tables in the presence of either microcytosis or macrocytosis — often correction using standard tables resulted in over-correction. BANNICK et al. (1937) also found that the E.S.R. was not increased in anaemia to the extent that would be anticipated from dilution experiments. One must exercise caution therefore in interpreting the results of " correction for anaemia." For these reasons and because of the presence of other statistically significant variables, we have not attempted to correct our results for anaemia.

Acute infection is probably the commonest " cause " of an elevated E.S.R. in the " normal " population. The almost universal occurrence of infection in kwashiorkor has been repeatedly emphasized. (Davel, 1956 ; Kahn, 1957 ; Campbell, 1956). In the cases in our series, signs of infection were usually detected on admission, yet despite this, the E.S.R. was within normal limits in the majority. The early phase of our observations were made in an overcrowded infant ward, and we closely investigated the possibility of these infants having become crossinfected after admission, when trying to account for the sudden rise in the E.S.R. during the second hospital week. No such evidence was forthcoming and we were able to confirm our observations on a large series of patients nursed in cubicles.

Walker et al. (1956) reported that a raised sedimentation was common amongst *apparently healthy* adult Bantu males who first come to work on the mines in the Transvaal, but after 4-15 months of a nutritionally adequate diet the E.S.R. returned to normal. The Gillmans (1951) found an abnormal E.S.R. in 28 of 30 " adult pellagrins " yet they could not establish any relationship between the E.S.R. and the severity of the disease, the presence or absence of sepsis or ulceration and fever. In their cases the E.S.R. frequently decreased after 3-4 weeks in hospital though 2 of 5 cases who were carefully followed, serially maintained their high E.S.R. on discharge from hospital. The same authors observed that in a group of infants with " infantile pellagra " the E.S.R. was normal in the presence of low serum proteins. They say " It seems quite clear from our findings that the sedimentation rate is not in any way increased by a lowering of the serum proteins affecting chiefly the albumin fraction. On the contrary it appears that in malnourished infants, the changes, either in plasma or in the red cells themselves, or in both, *prevent* the increase in the sedimentations rate usually found in severe respiratory infections in these infants." Suckling (1954) attributes the high E.S.R. found on admission in the minority of cases of kwashiorkor to tuberculosis. Our findings are that tuberculosis occurs in cases with low as well as high E.S.R.'s. Sex had no influence in the results in our cases.

CONCLUSION

Probably no single factor will account for the changes in the sedimentation rate which occur in kwashiorkor during treatment. With successful treatment, rapid metabolic changes occur and it seems likely that the inter-relationship of these factors, rather than any single factor, determines the sedimentation rate. There is a rapid increase of serum-proteins, the sudden increase of cholesterol and lipid concentration in the serum, marked haemodilution (probably due to the absorption of oedema fluid), high nitrogen retention, progressive anaemia and other factors which have yet to be investigated.

SUMMARY

The E.S.R. in kwashiorkor is low on admission to hospital and rapidly rises, with the onset of treatment, to abnormal levels. Statistically significant changes occur concomitantly not only in the E.S.R. but also in the serum cholesterol, albumin and the globulin fractions, P.C.V. and R.B.C. The role of oedema and haemodilution in determining the E.S.R. is discussed, and a need for more detailed blood volume studies is emphasized. The role of infection in determining the E.S.R. in kwashiorkor is discussed.

APPENDIX

REPORT ON THE STATISTICAL ANALYSES OF DATA ON E.S.R., PROTEIN CONTENT ETC.

(I) *Tests for significant differences between E.S.R. and all other components, and between Cholesterol and Albumin.*

The chi-square test, and the corner test were used where possible. For the weeks taken separately there was generally no significant difference between the given quantities. Taking all weeks together a dependence is obtained without exception, but owing to the large variations in the data no definite mathematical relationship could be established.

(II) *Correlation test between averages for different weeks.*

The correlation coefficient (r) was calculated for the different sets. In this case where eight pairs of points are available, the 5 per cent. and 1 per cent. significant values for the correlation coefficient are 0.707 and 0.834 or 0.621 and 0.789 if the one sided test is used so that the sign of r is taken into consideration. The following correlation coefficients were calculated.

Pairs tested	Correlation coefficient	Significant values %
E.S.R. — Cholesterol	r = 0.861	1
E.S.R. — Total Prot.	r = 0.727	5
E.S.R. — Alb.	r = 0.674	5
E.S.R. — Glob.	r = 0.790	1
E.S.R. — α-Glob.	r = 0.826	1
E.S.R. — β-Glob.	r = 0.686	5
E.S.R. — γ-Glob.	r = 0.760	5
E.S.R. — P.C.V.	r = (−) 0.700	5
E.S.R. — W.B.C.	r = (−) 0.728	5
E.S.R. — R.B.C.	r = (−) 0.698	5
E.S.R. — Hb.	r = (−) 0.583	Not significant
R.B.C. — Hb.	r = 0.964	1
R.B.C. — P.C.V.	r = 0.825	1
Hb — P.C.V.	r = 0.959	1
R.B.C. — Chol.	r = (−) 0.836	1

TABLE OF THE AVERAGES AND STANDARD DEVIATIONS

Period		ESR	Hb	PCV	RBC	T. Prot	Alb	Glob.	α Glob	β Glob.	γ Glob.	Chol	WBC
on adm.	av. St d.	12 14.39	10.2 1.57	33.9 4.97	4.347 0.53	4.1 0.60	1.8 0.37	2.3 0.45	0.8 0.23	0.6 0.24	0.9 0.28	129 54	9,761 2,306
(3-7) day	av. St d.	35 8.00	9.6 1.49	31.3 5.07	4.088 0.78	5.3 0.96	2.4 0.66	2.8 0.55	1.0 0.24	0.8 0.20	1.0 0.29	213 95	8,921 3,623
(8-14) day	av St.d	47 15.85	9.2 1.46	30.3 4.66	3.760 0.64	6.2 1.06	2.9 0.68	3.3 0.66	1.2 0.32	0.9 0.26	1.2 0.36	229 48	9,115 4,796
(15-21) day	av. St.d.	45 14.39	9.4 1.43	31.4 3.55	3.819 0.54	6.8 0.79	3.4 0.56	3.4 0.67	1.3 0.35	0.9 0.44	1.2 0.20	215 45	8,330 3,324
(22-28) day	av	39	10.0	32.5	4.188	6.7	3.3	3.5	1.3	1.0	1.3	175	8,455
(29-35) day	av.	37	10.2	32.5	5.233	6.8	3.3	3.5	1.2	1.0	1.3	173	9,028
(36-42) day	av.	37	10.4	33.2	4.375	6.9	3.4	3.5	1.2	1.0	1.3	179	9,155
(43+) day	av.	31	10.6	34.8	4.337	6.9	3.5	3.3	1.2	1.0	1.2	175	9,248

The standard deviations were only calculated for the first four periods, as thereafter the number of observations was not sufficiently large

There is no tendency for the standard deviation to decrease with different periods.

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EXCERPT

SEVEN YEARS OF A FAMILY PLANNING PROGRAM IN THREE TYPICAL JAPANESE VILLAGES

(YOSHIO KOYA, *Milbank Memorial Fund Quarterly*, 1958, 36, 363)

A choice of several birth control methods was offered by physicians to all families in three typical Japanese villages. More than half of the families who used birth control chose to use the condom. Diaphragm-and-jelly and the safe period were the second and third most popular. Sterilization was chosen by 9.5 per cent of those using contraception. Those sterilized were 2.7 times as many, when compared to the population, as those reported for Japan as a whole. After seven years, contraception was used by 75 per cent of the families exposed to pregnancy and by about 95 per cent of those with 4 or more children. The birth rate fell from 26.7 before the program began, to 14.6 in the 3rd and 13.6 in the 7th. This is 74 per cent of the rate for Japan. The net reproduction rate decreased from 1.51 to 0.81. The annual number of abortions fell from 31 in 1952-1953 to 9 in 1956-1957. The latter value is about one-eleventh of the rate for Japan. It is estimated that, if an extension of the program to all of Japan could have resulted in the same birth rate as those in the three villages, there might have been in the seven years 3,700,000 fewer unwanted births or four per cent of the present population.

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(I) *Tests for significant differences between E.S.R. and all other components, and between Cholesterol and Albumin.*

The chi-square test, and the corner test were used where possible. For the weeks taken separately there was generally no significant difference between the given quantities. Taking all weeks together a dependence is obtained without exception, but owing to the large variations in the data no definite mathematical relationship could be established.

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E.S.R. — γ-Glob.	r = 0.760	5
E.S.R. — P.C.V.	r = (−) 0.700	5
E.S.R. — W.B.C.	r = (−) 0 728	5
E.S.R. — R.B.C.	r = (−) 0.698	5
E.S.R. — Hb.	r = (−) 0 583	Not significant
R.B.C. — Hb.	r = 0 964	1
R.B.C. — P.C.V.	r = 0.825	1
Hb. — P.C.V.	r = 0.959	1
R.B.C. — Chol.	r = (−) 0 836	1

TABLE OF THE AVERAGES AND STANDARD DEVIATIONS

Period		ESR	Hb	PCV	RBC	T. Prot	Alb	Glob.	α Glob.	β Glob.	γ Glob	Chol	WBC
on adm.	av.	12	10 2	33 9	4 347	4 1	1 8	2 3	0 8	0 6	0 9	129	9,761
	St.d.	14.39	1 57	4 97	0 53	0 60	0 37	0 45	0 23	0 24	0 28	54	2,306
(3-7) day	av.	35	9.6	31 3	4 088	5 3	2 4	2 8	1 0	0 8	1 0	213	8,921
	St.d.	8 00	1 49	5 07	0 78	0 96	0 66	0.55	0 24	0 20	0 29	95	3,623
(8-14) day	av.	47	9 2	30 3	3 760	6 2	2 9	3 3	1 2	0 9	1 2	229	9,115
	St.d.	15 85	1 46	4 66	0 64	1 06	0 68	0 66	0 32	0 26	0 36	48	4,796
(15-21) day	av.	45	9 4	31 4	3 819	6 8	3 4	3 4	1 3	0 9	1 2	215	8,330
	St.d.	14 39	1 43	3 55	0 54	0 79	0.56	0 67	0 35	0 44	0 20	45	3,324
(22-28) day	av.	39	10 0	32 5	4 188	6 7	3 3	3 5	1 3	1 0	1 3	175	8,455
(29-35) day	av.	37	10 2	32 5	5 233	6 8	3 3	3 5	1 2	1 0	1.3	173	9,028
(36-42) day	av.	37	10 4	33 2	4 375	6 9	3 4	3 5	1 2	1 0	1 3	179	9,155
(43+) day	av.	31	10 6	34 8	4 337	6 9	3 5	3 3	1 2	1 0	1 2	175	9,248

The standard deviations were only calculated for the first four periods, as thereafter the number of observations was not sufficiently large.

There is no tendency for the standard deviation to decrease with different periods.

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EXCERPT

SEVEN YEARS OF A FAMILY PLANNING PROGRAM IN THREE TYPICAL JAPANESE VILLAGES

(YOSHIO KOYA, *Milbank Memorial Fund Quarterly*, 1958, 36, 363)

A choice of several birth control methods was offered by physicians to all families in three typical Japanese villages. More than half of the families who used birth control chose to use the condom. Diaphragm-and-jelly and the safe period were the second and third most popular. Sterilization was chosen by 9.5 per cent of those using contraception. Those sterilized were 2.7 times as many, when compared to the population, as those reported for Japan as a whole. After seven years, contraception was used by 75 per cent of the families exposed to pregnancy and by about 95 per cent of those with 4 or more children. The birth rate fell from 26.7 before the program began, to 14.6 in the 3rd and 13.6 in the 7th. This is 74 per cent of the rate for Japan. The net reproduction rate decreased from 1.51 to 0.81. The annual number of abortions fell from 31 in 1952-1953 to 9 in 1956-1957. The latter value is about one-eleventh of the rate for Japan. It is estimated that, if an extension of the program to all of Japan could have resulted in the same birth rate as those in the three villages, there might have been in the seven years 3,700,000 fewer unwanted births or four per cent of the present population.

THE HEALTH PROBLEMS OF THE PRE-SCHOOL CHILD IN AFRICA AND THE ROLE OF THE PUBLIC HEALTH NURSE IN THEIR SOLUTION

by

N. M. B. Dean

*(Late Senior Specialist, Eastern Region, Nigeria)**

This paper is divided into two parts, firstly a survey of these health problems as seen from a clinician's standpoint, and secondly some suggestions as to their solution, with particular reference to the role of the public health nurse.

It should be emphasized that this paper, and the investigations on which it is mainly based, make no pretence to being " specialist " in their nature, or in any way exhaustive. The investigations recorded and the suggestions contained herein are those of a doctor doing ordinary hospital practice, and there has been no time for research or deeper investigation.

As an appendix the results are given of tuberculin-testing done in 1954 in 313 children of this age group. This was done as part of a larger investigation into the probable incidence of tuberculosis, and all the negative reactors were BCG vaccinated.

The Problems

The observations recorded are mainly the results of an investigation carried out on 200 unselected children of under school age, attending the Children's Clinic at St. Margaret's Hospital, Calabar, in the Eastern Region of Nigeria.

This hospital is one serving a fairly typical Eastern Nigerian urban area, and therefore the clinical findings and abnormal conditions recorded herein may be accepted as broadly indicative of those present in other urban areas throughout the Region.

Although, as pre-school children are not recorded as such in our hospital statistics, I cannot give accurate figures, it is estimated that about 3,000 children of this group attend this clinic annually and that each attends on an average about three times. This figure of 3,000 is about half the number of pre-school children in Calabar. It is also perhaps of interest to note that, in contrast to adults attending the outpatient department, the vast majority of pre-school children attending have actually some more-or-less serious complaints. Very little of a completely trivial nature is seen in these clinics.

It is realised that an investigation based on such a small number of children is insufficient to give more than a broad picture of health and disease in the pre-school age community as a whole, but it is hoped that in doing even this it may be of interest to those dealing with the same problem elsewhere.

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* I am grateful to the Director of Medical Services, Eastern Region, Nigeria, for the opportunity of writing this paper, and to my wife without whose help and encouragement it would not have been possible.

Procedure. Children of pre-school age attending the children's clinic, in addition to any investigations pertinent to their presenting complaints, were examined with particular reference to : (a) general nutrition ; (b) skin disease ; (c) palpability of the spleen ; (d) presence of deformities, hernias etc.

In addition, they were sent for the following laboratory examinations : (e) haemoglobin estimation (Sahli method) ; (f) slide for malaria parasites ; (g) microscopical examination of the faeces.

All children who had attended hospital in the preceding three months were excluded from the investigation as any treatment then obtained would vitiate the results. Otherwise there was no selection whatsoever, and all pre-school children attending on the days when the necessary investigations could be done were included.

I have arbitrarily divided the children so examined into two groups, those up to 2 years of age, and those from 2 years to 5 years. Although 40 out of 110 in the former group were under 1 year of age and therefore properly classified as infants, I have felt it better to include them with the others. They attend the same clinic and present largely the same problems as those between 1 and 2 years.

RESULTS

The total number examined was 200, of whom 110 were in the age group 0-2 years and 90 in the group 2-5 years.

(A) *Presenting Complaints*

TABLE I. Presenting complaints in 200 pre-school children.

	Age 0-2 yrs.	Age 2-5 yrs.	Total
Fever	45	35	80
Frequent stool	36	15	51
Cough	22	18	40
Skin conditions	20	19	39
Abdominal pain	12	15	27
General weakness	10	5	15
Boil, abscess	8	5	13
Injuries	1	7	8
Discharging ear	6	1	7
Constipation	4	2	6
Deformities	6	—	6
Adenitis	1	4	5
Prolapsed rectum	—	5	5
Sore mouth	2	2	4
Yaws	2	2	4
Inguinal hernia	2	2	4
Passed worm	2	2	4
Oedema	—	3	3
Ulcers	—	3	3
Burns	2	1	3
Conjunctivitis	1	1	2
Fits	1	—	1

The majority of the children had more than one complaint (Table I).

Fever, abdominal symptoms, skin conditions, general undernourishment and deformities are discussed in greater detail below. Of the remainder the following deserve special mention :

Cough. Only 20 (11 aged 0-2 years, and 9 aged 2-5 years) of the 40 complaining of cough had this as their primary symptom. All except 4 of these 20 had a mild bronchitis, but these 4, all in the younger age group, were suffering from bronchopneumonia which is a seasonal complaint in this area, occurring almost exclusively during the rains.

Yaws. This is probably the one disease where a wide variation in incidence may be found within Eastern Nigeria. In some areas sufferers from yaws would constitute much more than half of the total number of young children attending a doctor.

(B) *Special Investigations*

(a) *General nutrition.* Twenty-four children (12 per cent.), of whom 18 were in the younger age group, were considered to be thin or undernourished. As no definite standards of development were used, this figure cannot be more than an expression of opinion. Nevertheless considering the fact that this town is a well-to-do one, I consider this figure to be significant, and disturbingly high. There is no doubt that in many rural and other urban areas in this country the percentage would be much higher. One case of true kwashiorkor was seen, but, in the previous three months, three such cases were admitted to hospital.

Only one child, aged about 4 years, was seen suffering from isolated vitamin B deficiency. This compares with 21.4 per cent. incidence (judged by the same criteria by the same person) in a series of 1,714 children of school age.

(b) *Skin conditions.*

TABLE II. Incidence of skin disease in 200 pre-school children.

	Age 0-2 yrs.	Age 2-5 yrs.	Total
Scabies	24 (22%)	32 (36%)	56 (28%)
Tinea	9	9	
Non-specific Dermatitis	6	2	
Yaws	2	2	

In comparatively few of the 56 cases of scabies was the skin condition mentioned as a presenting complaint. The majority of mothers and children in this area appear to regard scabies as a normal event. The figure of 36 per cent. for age group 2-5 years compares with 32.8 per cent. in 1,714 school age children. Most of the ringworm was *Tinea capitis*, and, in the majority of the dermatitis cases, the scalp and/or ears were affected.

(c) *Enlarged spleen.* The spleen was palpably enlarged in 28 (14 per cent.) children (13 aged 0-2 years, and 15 aged 2-5 years). In only one case (of kwashiorkor) was concomitant hepatic enlargement noted. It was assumed that the cause of the splenic enlargement in the others was malaria, but Table III shows the lack of correlation between

TABLE III. Splenic enlargement and malarial blood films in 200 pre-school children.

	Age 0-2 yrs.		Age 2-5 yrs.	
	Parasites found	Parasites not found	Parasites found	Parasites not found
Spleen palpable	4	9	7	8
Not palpable	28	69	33	42

clinical enlargement of the spleen and the finding of malaria parasites at one single examination.

It would have been interesting and useful to have made repeated examinations for parasites in those with enlarged spleens, but this was unfortunately not feasible. Hitherto, I have given an intensive and repeated antimalarial course as a routine to all children whose spleen was discovered to be enlarged, and this policy I intend to continue in spite of these equivocal results.

The figure of 14 per cent. enlarged spleen in this series compares with 17.3 per cent. in 1,714 school children.

(d) *Hernia and deformities.*

TABLE IV. Inguinal hernias, large umbilical hernias and congenital deformities in 200 pre-school children.

Umbilical hernia	15
Inguinal hernia	5
Talipes equinovarus	1
Talipes varus	1
Severe genu valgum	1
Drop foot	1
Malformation of vulva	1

Only large umbilical hernias, which it was considered would probably not close with conservative treatment, were included. None of these was complained of, again presumably because this condition is so common. Of the remaining conditions, all except one were brought specifically for treatment, and all were remediable.

In my opinion, there are many more remediable deformities among such children ; the commonest are probably severe degrees of knock-knee and bow leg. The majority of these never come to hospital as the parents do not realise that the defects are indeed correctable. During the nine months ending April, 1954, more than 10 cases of talipes equino-varus, genu valgum and genu varum (mostly in young children) were picked up in the streets and subsequently corrected surgically.

(e) *Haemoglobin estimation.* Figure 1 illustrates in graphic form the disturbingly low average percentage. All the estimations were done by the Sahli method and have been checked by comparison with presumed " normal " adult bloods.

Table V attempts to relate these percentages to known causes of anaemia, namely

TABLE V. Relationship between haemoglobin level and (i) stools positive for hookworm ova and (ii) blood films positive for malaria.

Haemoglobin	Age 0-2 years				Age 2-5 years			
	Hookworm	Malaria	Nil	Total	Hookworm	Malaria	Nil	Total
20-29%	—	—	—	—	2	1	—	2
30-39%	—	1	—	1	—	—	—	—
40-49%	—	1	5	6	1	1	—	2
50-59%	1	5	25	30	10	10	2	18
60-69%	1	20	33	55	14	13	15	40
70-79%	—	4	13	17	9	9	12	27
80-89%	—	—	1	1	—	1	—	1

malaria and hookworm infestation. It will be seen that at least in the younger age group there is little demonstrable relationship. The anaemias in this group are therefore probably nutritional in origin.

On the other hand in the older age group the relationship between hookworm and malaria on the one hand, and low haemoglobin percentages on the other, is probably significant.

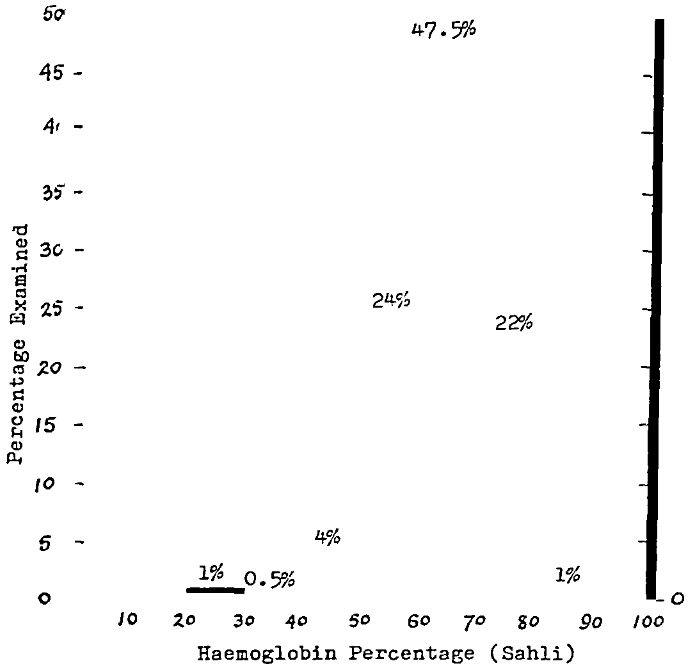


FIG. 1. Histogram showing haemoglobin levels in 200 pre-school children.

(f) *Malarial parasites.* There was a total malaria infection of 29 per cent. in the younger age group and 44 per cent. in the older children. As these are the positive findings from one blood film only, the true percentage of those actually infected is undoubtedly much higher.

TABLE VI. Positive blood films in 200 pre-school children.

	Age 0-2 years	Age 2-5 years
Subtertian	30	36
Quartan	2	4
No parasites	78	50

Table VII shows the relationship between fever as a presenting symptom and the finding of malaria parasites.

Many of those complaining of fever and without parasites were suffering from other obvious fever-producing diseases such as bronchitis and enteritis, and this figure therefore has no significance. On the other hand the fact that those with positive blood films not complaining of fever outnumber those similarly infected who had fever as a presenting symptom is of some significance and will be alluded to later.

TABLE VII. Association of fever and positive blood films in 200 pre-school children.

	Age 0-2 years		Age 2-5 years	
	Parasites present	Not present	Parasites present	Not present
Fever	16	29	18	17
No Fever	16	49	22	33

(g) *Examination of faeces.* Table VIII gives the detailed abnormal results. No account has been taken of the helminths of doubtful pathogenicity. These were noted and, where appropriate, treated, but I considered that their inclusion in the statistics would serve no useful purpose.

TABLE VIII. Positive stool findings in 200 pre-school children.

	Age 0-2 years	Age 2-5 years
Ascaris	23	40
Hookworm	2	35
E. histolytica	5	1
Cellular exudate etc. only	16	1

TABLE IX. Relation between abdominal symptoms and positive stools for ascaris, hookworm and *E. histolytica* (E.h.) in 200 pre-school children.

	Age 0-2 years					Age 2-5 years				
	Ascaris alone	Hookworm alone	Both	E.h.	None	Ascaris alone	Hookworm alone	Both	E.h.	None
Diarrhoea	4	—	1	4	21	1	1	3	1	7
Colic etc.	2	—	—	1	8	1	1	6	—	5
No symptoms	15	—	—	—	49	11	9	15	—	26

The marked difference between the two age groups, in particular with regard to hookworm infestation and findings indicative of non-specific enteritis, are significant.

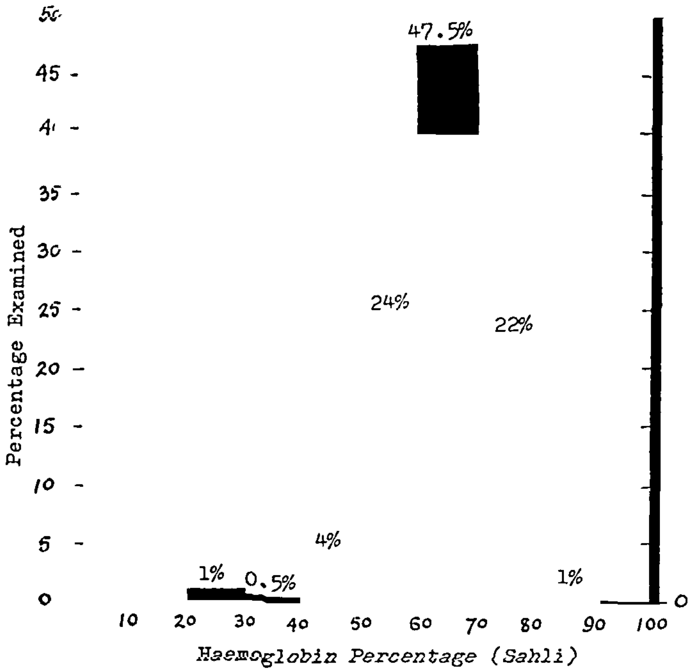
Table IX attempts to relate the presence of helminths and *Entamoeba histolytica* to the occurrence of abdominal symptoms.

In other words, the number of patients infested with helminths showing no abdominal symptoms (50) was more than double the number similarly infested who had abdominal symptoms (20). Of the latter number, it may even be doubted whether the symptoms were actually attributable to the helminths in all cases.

THE SOLUTION

Any integrated scheme for the improvement of the health of these children must in the first place be a definite scheme with this end in view. The problems are at least as important as those of specific diseases such as yaws, leprosy and tuberculosis, and deserve at least equal consideration. The scheme must be implemented by a team of doctors, malaria and hookworm infestation. It will be seen that at least in the younger age group there is little demonstrable relationship. The anaemias in this group are therefore probably nutritional in origin.

On the other hand in the older age group the relationship between hookworm and malaria on the one hand, and low haemoglobin percentages on the other, is probably significant.



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THE SOLUTION

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While therefore according to the terms of reference of this paper it is principally the role of the nurse which must be discussed, it is not possible to treat her function as an isolated one, and brief mention will first be made of the duties of the other members of the team.

(1) *The Doctor*

I do not propose to enter into detail in regard to the role of the doctor in improving child health. His duties, for the most part, are sufficiently obvious and, in regard to actual treatment of diseases found, there are so many opinions that I hesitate to put forward mine as better than any others. However, one or two points must be emphasized.

(i) The doctor must be in the first place the co-ordinator of all the work of the team, as unless the efforts of each member of the team are co-ordinated then the work of each individual loses much of its value.

(ii) Adequate records are absolutely essential, and it seems preferable that these should be kept by the doctor.

(iii) It is also, I believe, essential that the hospital clinic to which children are referred should be run completely separately from those dealing with adults since the problems are so different. Combination with clinics for school children is, however, convenient and satisfactory, since many of the problems, as is shown by this small investigation, are similar.

(iv) At these clinics, if the findings in this investigation are confirmed elsewhere, it is at least arguable whether every child should not be given routine anti-malarial, anti-helminthic and iron treatment. The large proportion of positive findings in regard to malaria and helminths without symptoms referable to these conditions and the low average haemoglobin percentage suggest that the only two alternatives, until health education and improving hygienic standards eradicate these conditions, are (a) to examine the blood and faeces of every sick child irrespective of its complaints, or (b) to treat empirically possible malarial and helminthic infections and anaemia at regular intervals as suggested above. The first alternative would put a heavy added strain on laboratory services where these are available at all, and is not practicable in the vast majority of cases. The second alternative is undoubtedly expensive in drugs and may not be considered sound medically, but is certainly preferable in the presence of findings such as have been recorded here.

(2) *The Laboratory Technician*

It is essential that he should be absolutely reliable. The scope of his work (in all but big regional centres) need not be large — ability to perform routine examinations of blood, urine and faeces, is probably sufficient for any ordinary team — but, as in so many diseases in the tropics diagnosis and treatment depend almost wholly on laboratory results, the importance of being able to rely absolutely on the laboratory technician cannot be over-emphasized. In this respect he is the most important man in the team.

(3) *Voluntary Services*

Here in Calabar, as elsewhere, services such as those of the Red Cross Society may be made use of in the running of nutrition clinics. Care should be taken that they do not duplicate the work of infant welfare clinics, and in my opinion they should accept only cases referred to them by the doctor or public health nurse, so that any pathological conditions may first be eradicated.

(4) *Schools: Adult Education Centres*

The health teaching must be in accordance with accepted medical opinion in the area served. It should be unnecessary to state this, but in fact it has not infrequently been found that health education, where given at all, bears little or no relation to local problems and their solution. More use ought to be made of the services of the doctor and public health nurse in this respect.

(5) *Local Authorities*

It is unnecessary to do more than state the important part which these should play in the improvement of housing, hygiene and sanitation, and that without such improvement, efforts of the other components of the team can but touch the fringe of the problems.

(6) *The Public Health Nurse*

She is in many ways the most important member of the team, for she and she only can see the child in his home environment, can therefore view its health problems not as isolated ones but as part of the greater problems of the family and the community as a whole, and can play a much greater part in what is, after all, the more vital work of disease prevention rather than cure.

The findings recorded in the first part of this paper will indicate her most important duties :

(a) *Nutrition.* As the raising of nutritional standards is the most essential single contribution which can be made to the health of children, so this aspect of the nurse's work is also the most valuable. Any nurse working in this field must therefore have understanding not only of dietetics generally, but must know intimately the food problems and dietetic deficiencies to be met with in her own area.

Work in this sphere has for long been the most uphill labour undertaken by the nursing profession, partly because nurses are insufficiently grounded in local dietetic and nutritional problems, and partly because the local population as a whole (in this area at least) is not receptive to advice regarding changes of diet. They have little conception of the idea of preventing disease, and regard its cure to be a matter wholly for medicines. They are apt to ignore or resent any attempts to change their feeding habits — and, in that attitude, they are not appreciably different from many, perhaps most, people in countries of much higher economic development.

The remedy for this, in so far as it is a medical problem, lies partly in co-operation with schools and adult education schemes, and partly by the establishment of nutrition clinics, but mostly in energetic domiciliary visiting by knowledgeable health nurses.

The biggest practical difficulty in respect of nutrition problems of the pre-school child seems to me to be the discovery of cases of under- and mal-nutrition. Infants are dealt with in maternity hospital post-natal clinics and children over five are for the most part reasonably adequately looked after by the School Medical Service, but between the ages of about nine months and five years there is a period at the most important part of a child's life when there is no adequate supervision. The type of parents whose children are undernourished are the least likely to bring these children for medical attention and, therefore, nearly the whole onus for discovering, treating and preventing recurrence must lie with the medical and nursing personnel.

Apart from systematic house-to-house visitation which is not practicable in most areas, the method which offers most chance of success in discovery is to ensure that all cases of undernourishment in infants attending infant welfare clinics, in children attending school, and in children of all ages attending hospital, be reported to the public health nurse who will thus discover any errors of nutrition in the rest of the family.

The nurse should then if possible refer all such cases to hospital for investigation before she deals with them on a purely nutritional basis. At least weekly visits thereafter are necessary to ensure that advice is followed and to check progress by means of weighing and general assessment. A card should be kept for each child, and all such details entered on it.

It is important that a regular medical check-up, say every three months, is made of these children and this again necessarily involves a close liaison between the nurse and the doctor concerned and a more efficient documentation than has hitherto been found possible in this country.

(b) *Skin health.* Nurses can easily be trained to recognise and treat the two commonest skin diseases — scabies and tinea. The treatment of such conditions as hospital out-patients is at best very incomplete in view of the almost certain re-infection in the home, and this the nurse can remedy. It might be considered that these complaints are trivial, but superinfection with resultant adenitis and abscess formation is common, and this may have a most debilitating effect on a child whose health is already much below par.

(c) *Malaria.* A simple scheme of anti-malarial treatment might with great advantage be laid down, for use by the nurse. This could either be used generally for every case seen by her in the course of her duties (as has been suggested) or in treatment of fever or an enlarged spleen, which she should be taught to recognise. Though many specific anti-malarial measures such as mosquito nets, prophylactic drugs etc., are impracticable for the generality of the population at present, the nurse must of course advise regarding general measures against mosquitoes.

(d) *Remediable deformities.* The majority of crippling deformities seen in adult life in this country could have been remedied, or at least much ameliorated, if treated during the pre-school age. In nearly all such cases, the sufferers are not brought to hospital because of the ignorance of the parents that the condition is correctable. In nearly all such cases also, in this town at least, treatment has been eagerly accepted when offered. The nurse must, therefore, be familiar with the types of case with which her nearest hospital can deal, and must be able to recognise the majority of them.

(e) *Harmful local customs.* (i) In particular the fear on the mother's part of " constipation " is a constant bogey. More than one mother in the present series confessed to giving her child a daily enema, and a not very infrequent cause of death in our children's wards is an overdose of a purgative. The need for education in such matters is urgent, for in my opinion such practices are becoming increasingly common. Here also the nurse is the most valuable educator. In a similar category is found the indiscriminate administration of market-bought sulphonamide tablets to children.

(ii) Male and female circumcision by unskilled practitioners is common even in a town such as this where school education is so widespread, and is by no means confined to the illiterate classes. Its results both in childhood and (in females) in later life are often horrifying. It is doubtful whether the nurse can succeed where the doctor's strictures have failed, but it is at least essential that she should pay more than lip-service in an attempt to eradicate these dangerous practices.

(f) *Tuberculin testing and BCG vaccination.* Although this has not hitherto formed part of her duties, it seems reasonable that, in areas where there is a grave shortage of doctors and at the same time a considerable prevalence of tuberculosis the nurse should be trained in Mantoux-testing and BCG vaccination and should carry this out under supervision as part of her preventive work.

(g) *Teaching by example.* Many more duties of the public health nurse could be enumerated, but perhaps it is sufficient finally to state that probably her greatest contribution in the long run to the improvement of child health is by her example in her family, before her patients and in the community as a whole.

CONCLUSION

As has been stated, neither the investigation nor the suggestions based upon it can be regarded as exhaustive. Sufficient perhaps has been written to give some idea of the magnitude of the problem, and of some specific ways which may at least help towards its solution.

APPENDIX

In 1954 as part of a BCG vaccination campaign in which 8,097 persons were tuberculin tested, 313 children under school age were dealt with and showed the following results :

Age (years)	Negative	Positive	Total	Positive (per cent.)
0-2	120	2	122	1.6
2-5	176	15	191	7.9

The method used was intradermal injection of approximately 0.1 ml. of 1:1000 Old Tuberculin : and the criterion of positivity was a wheal of 6 mm. in diameter or over. All negatives were BCG vaccinated with freeze-dried BCG supplied by the Pasteur Institute, and the percentage conversion over the whole series was 94.1 per cent.

EXCERPT

Nouvel Essai de Traitement des Teignes du Cuir Chevelu par l'Asterol au Congo Belge

(Vanbreuseghem, R. and Braun, P. *Ann. Soc. Belge Trop. Med.*, 1958, 37, 933)

Ringworm of the scalp appears to be common among children in parts of the Congo, as in some other tropical regions, including Jamaica. Treatment by depilation is usually neither available nor practicable. The authors report a two-thirds cure-rate in a mixed group of cases of ringworm of the scalp due to various fungi following the local application of ointment or tincture of asterol. No toxic effects were observed.

THE PERILS OF CHILDHOOD IN UPPER BURMA

by

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Burmese childhood, although not perhaps so hazardous as its African counterpart, is a time of considerable peril. In this paper, it is hoped to draw attention to the part that public health and sanitation could play in reducing child mortality and to stress the importance of adequate antenatal and paediatric care. It is realized that the questionnaire form of investigation employed may give results which are not statistically accurate ; however, there is equally little doubt that it does give an indication of the size of the problem which has to be faced.

This account is based on two main studies. Firstly, a questionnaire sent to a large proportion of our employees' wives, and secondly, on the patients we have seen in the paediatric wards of this hospital and in the outpatients during the last two years.

PATIENTS, ENVIRONMENT AND SOCIAL FACTORS

Chauk lies in the dry belt of Upper Burma. In the hot weather the temperature reaches about 110°F. and in the cold 70°F. Rain falls mainly in September and October, about 24 inches a year.

By Eastern standards, it is a relatively healthy town with no malaria ; a few cases of cholera, smallpox and plague occur seasonally. Tuberculosis and leprosy are common, and just outside the town is the site of an old leper colony. Syphilis is prevalent ; gonorrhoea is rarer. Amoebiasis, or rather cyst-passers, are widespread.

The women interviewed in this series (Table I) were the wives of employees (ranging from clerks to labourers) of the company. These men work either in the refinery or in the local oilfields and their ancillary services. Economically, company employees have an advantage over the average Burman. In addition, they receive free medical treatment for themselves, wives and children.

Questionnaire forms were filled in by two investigators either in the hospital outpatient department or at the various company housing areas, all of which were visited. The number interviewed probably represents about 70 per cent. of the total wives.

Chauk was fought through, and the refinery and oilwells destroyed to prevent them being used by the Japanese in 1942 ; it was occupied by the Japanese, and then fought through again in 1945. In 1948, it was under the control of the insurgents for some six months. During the period of the Japanese occupation, food was in very short supply and there was considerable unemployment in the area. Rice was of extremely poor quality, sugar was virtually unobtainable (so that only village-made *jaggery* was employed), meat and vegetables were most expensive, and coffee and tea were scarce. However, as the town is on the Irrawaddy, some fish was obtainable.

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* I am indebted to Professor R. W. B. Ellis for his helpful advice in the preparation of this paper, to the Management of the Burma Oil Company (1954) Ltd. for facilities granted me, and to all those who cooperated with the questionnaire.

TABLE I. Parity in women in Chauk, Upper Burma and mortality in their children.

Age groups (years)	15-25	26-35	36-45	46-60	Total
Total interviewed	174	412	380	141	1107
Number of multipara	165	407	379	141	1092
Number of nullipara	9	5	1	0	15
Number of deliveries	361	1689	2052	692	4794
Average deliveries per parous woman	2.18	4.15	5.41	4.91	4.39
Number of stillbirths	16	35	41	13	105
Stillbirth rate per 1,000 births	44.3	20.7	20.0	18.7	21.1
Average stillbirth per parous woman	0.10	0.09	0.11	0.09	0.09
Neonatal mortality/1,000 live births	46.3	52.0	38.8	25.0	40.1
Infant mortality/1,000 live births	138.7	163.2	156.1	213.5	163.4
Early childhood mortality (up to 5 years)/ 1,000 live births	165.2	200.7	219.3	279.8	217.1
Childhood mortality (up to 15 years)/ 1,000 live births	—	211.6	241.1	312.2	235.0

RESULTS OF THE QUESTIONNAIRE

The number of women who were questioned was 1,107, of whom only 15 were nullipara. Their ages ranged from 15-60 years. Various nationalities, including Burmans, Indians, Sino-Burmans, Indo-Burmans, Karens and a few Anglo-Indians, were included. No significant national differences were apparent in the questionnaire results. An arbitrary division was made into four age groups (in years) 15-25, 26-35, 36-45 and over 45. The proportion of women in each group was 15.7, 37.2, 34.3 and 12.8 per cent. respectively.

The total number of deliveries was 4,794, including 105 stillbirths. Each parous woman had given birth to an average of 4.38 live children. Ko Ko (1957) gives an average figure per Burmese woman of 3.2 children born alive.

Stillbirth rate. The overall stillbirth rate per 1,000 births was 21.1 in this series. The 1956 figure for Burma was 39.6, based on the records of 74 Municipal Towns. From the Table, it may be seen that the stillbirth rate in Group I was 44.3, and in Groups II, III and IV 20.7, 20.0 and 18.7 respectively.

The higher rate in Group I is possibly explained by (a) the small number of deliveries in this group, and (b) the custom for primipara to return to their mothers in the local villages for the first delivery, and there to experience the additional hazards of vigorous abdominal massage with kneading the fundus of the uterus, this being usual local obstetric practice ; (c) the recent, and in my opinion, completely indiscriminate use of intramuscular pitocin in case of possible delay in labour. All too frequently the results of such treatment are observed. There is no control of the sale of drugs in Burma, and anyone may purchase practically any preparation. It is noted that the average number of stillbirths per parous woman is not raised in Group I ; this suggests that the first or second delivery results in a stillbirth.

The overall stillbirth rate is about the same as the present figure in the United Kingdom, and is relatively very low considering the prevalence of syphilis, the poor maternal diet and low maternal haemoglobin (approximately 72 per cent. or 10.6 g. is the average antenatal clinic finding).

In fact, this figure was so low as to warrant special enquiries as to whether the women interviewed were concealing the true number of stillbirths for some social or religious reason. However, no valid reason to doubt their veracity was found ; there is no apparent Burmese superstition concerning stillbirths and no " disgrace " to admitting having had one. One explanation given me was that the local midwives are more than usually proficient by virtue of their knowledge of witchcraft. This is not my experience. Interference at all stages of labour seems quite customary.

Neonatal mortality rate. The average for the whole series was 40.1 per 1,000 live births. The 1956 rate for Burma, collected from 37 urban towns, was 57.1. The figure for England and Wales (1956) was 17.

The main causes of neonatal deaths are probably : (i) unsatisfactory local obstetrical practice ; (ii) the smallness of the babies. (The weights for some 200 infants born in this hospital during 1957 show an average birthweight of 6 lbs. 7 ozs. for boys and 6 lbs. 3 ozs. for girls — of these 28 per cent. of the boys and 26 per cent. of the girls were under 5½ lbs. at birth and, although " premature " by definition, a large number of these babies were full term, thus suggesting that smaller babies in Burma may have a racial or genetic causation. POSTMUS (1957) has recorded similar findings).

It has been shown in the United Kingdom that the incidence of both prematurity and neonatal deaths can be reduced by regular attendance at antenatal clinics. The setting up of such clinics and special training for all those engaged in obstetrics will no doubt greatly reduce the neonatal death rate over the next few years in Burma.

Infant mortality. The total infant mortality for the series was 163.4 per 1,000 live births. The 1956 figure for Burma (calculated for 74 municipal towns) was 166.8 ; the average figure for the years 1947-1956 was 248. For England and Wales (1956), the figure was 24.

Two main factors appear to be responsible for this :

(a) *Inadequate diet.* The great majority of the children are breast-fed up to at least two years, sometimes considerably longer, even up to five or six. No milk other than human is given to the infant, and, in this part of Burma, cow or goat milk is drunk mainly by calves or kids. Occasionally bottle feeding with condensed milk is attempted, but this usually ends in disaster for the infant.

At about 2 years of age, some rice is given, but only after it has been first chewed by the mother ; salt is sometimes added. In recent years, in the more sophisticated households the rice, instead of being chewed, is pressed through muslin gauze. Water is occasionally given by teaspoon. Then the child is weaned straight on to curry and rice. Fresh vegetables and fruit are expensive in the dry belt and, with the exception of bananas and guavas, seldom eaten.

An analysis of Burman breast milk showed an average protein content of 1.6 per cent. five days after the birth of the infant, and an average of 1.13 per cent. from one month to

2 years, so that the protein content does not appear to fall with prolonged breast feeding. Although it seemed probable that the quantity of milk was much reduced, as in test-weighings for 24 hours we have frequently found that the infant only takes 10-12 ozs./day.

Breast feeding is all self-demand and no attempt is made to give feeds at definite times. It is customary for the infant and mother to sleep together, the child with his mother's nipple in his mouth. If on admission to hospital, an infant is put on definite feeds, and test weighing done, one finds that only 1½-2-oz. of milk are being taken at each feed. Complementary feeding is usually followed by gratifying improvements in the infant's health, but the dangers to the infant of permitting most mothers to prepare bottles when they leave hospital are very great, as gastro-enteritis and thrush usually result in a matter of days.

(b) *Defaecation habits.* Children are permitted to defaecate whenever and wherever they have the urge and this commonly happens in the immediate vicinity of their homes. The resultant fly-borne spread of infection is a serious menace to all, as bacillary and amoebic dysenteries abound. Although personally extremely clean, the average Burman has no idea of environmental sanitation ; as Ko Ko (1957) says " latrines are conspicuous by their absence." One wonders what would be the effect on child health if a major national latrine building campaign were inaugurated that were capable of both providing deep pit latrines and somehow ensuring their use.

Early child mortality (up to 5 years). From the questionnaire an average figure per 1,000 live births was found to be 217.1. So that one in five children born alive fails to reach his fifth birthday.

The greater part of this mortality is caused by two principal conditions — the bowel infections and dysenteries, and the respiratory infections. The former are particularly severe in the dry weather and the latter in the wet. As previously mentioned, fly and direct mother-to-child spread of infection must be widespread. Children with diarrhoea respond well to treatment when seen early, but dehydrated late cases respond very slowly and need a long convalescence. Tonsillitis occurs all the year round, perhaps because Chauk is seldom free from dust. Practically all the children are anaemic by Western standards.

Mention may now be made of a few of the common conditions for which children are admitted to hospital. Multiple boils, occurring in both children and adults, are prevalent in the hot weather and usually follow prickly heat. Septicaemia often results. Infected prickly heat and chicken-pox occur at this time, smallpox usually a little earlier. Acute osteomyelitis is no rarity. Measles, when it does occur, is severe. Malarial cases are very seldom seen.

Tuberculosis is common, and, in children, usually presents as cervical adenitis or tabes mesenterica, both of which respond well to treatment. The tuberculous infection seen in the children is most unlikely to be bovine in origin since practically no cow's milk is drunk. It is presumably a human strain which reaches the gut via the maternally chewed rice, or cheroot (it is not uncommon to find the latter used as a " pacifier "), or by inhalation direct into the pharynx. Congenital tuberculosis, via a caseating lesion in the placenta, is rare, but usually leads to death from miliary tuberculosis.

Enteric fever is common, deficiency diseases are not. Only one case of diphtheria has been admitted to hospital in the last two years, but that required an immediate tracheotomy. During childhood, many a later case of leprosy acquires infection as a result of living in close proximity to infective cases. *Ascaris lumbricoides* and *Oxyuris vermicularis* are commonly seen, and the former sometimes appears to be associated with violently swinging temperatures. *Ankylostoma duodenale*, not infrequently found in adults, rarely occurs in children in this part of Burma, although it is common in the delta region of the south. Giardiasis is prevalent.

In spite of an abundance of snakes, including the cobra, Russell's viper and the Krait, children suffering from snake-bite are fortunately very rare indeed in this area. Rabies has been seen in adults, but in spite of many cases of dog bite, no children have so far been seen with this disease.

Burma has not escaped the universal trend for bigger and better antibiotics, which are given with irresponsible abandon and a frightening lack of realization. More and more reports return from the laboratory marked " Resistant to . . . " Unfortunately the more injections he gives the more the average Burman respects his physician.

Frequently, parents approach the hospitals with their sick children only as a last resort. Various local remedies are inevitably tried first. For instance, diarrhoea in infants is treated by rubbing the abdomen with a special ointment and then covering it with tobacco leaves. Both constipation and worms are treated by inserting into the anus either a whittled down piece of washing soap, or betel leaf stalks soaked in kerosene.

It is a Burmese custom that should a member of the family be admitted to hospital, the rest of the family go along to take care of him. There is no doubt but that Burmese children up to ten or twelve are extremely dependent on their parents, and separation in hospital appears to be an even greater ordeal than for Western children. Although the presence of the whole family at the bedside is obviously impossible from an administrative point of view, daily visiting is encouraged and appears successful. The children rapidly settle down in hospital and look after each other with almost adult understanding. No more wonderful patients — happy, humorous and uncomplaining — could be found anywhere.

In conclusion, it is considered that this appalling wastage of child life could be reduced by adequate antenatal care for the mother which would lead to healthier babies, by more skillful obstetrics, by child welfare clinics (staffed by trained paediatric nurses or doctors), by a greater awareness to be shown by local authorities of the benefits of sanitation and public health, and by an increased attempt to educate the people to trust the hospitals, which in turn must be efficient.

SUMMARY

An account is given of a questionnaire answered by 1,107 women about their maternity histories and the fate of the 4,794 children delivered. The low stillbirth rate is discussed. Reasons are suggested for the high neonatal and infant mortality rates (40.1 and 163.4 per 1,000 live births respectively). The common causes of death are one of the diarrhoeal diseases or respiratory infection. A brief mention is made of other common children's disease found in Chauk. It is submitted that improved antenatal care, skilled obstetrics, well-staffed child welfare clinics, and more paediatric inpatient beds, together with an improvement in sanitation could reduce the infant and childhood mortality figures considerably.

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EDITORIAL

NEONATAL STAPHYLOCOCCAL DISEASE

While there is usually little reliable information concerning the incidence of neonatal septicaemia in the tropics, there can be little doubt that it must be both common and an important cause of mortality in this age-group. Certainly opportunities for infection, especially via the umbilical stump and skin, are great in unhygienic home circumstances.

The vagueness and lack of specificity of the clinical picture at this age is well-known, but cannot be over-emphasized. In particular, the common absence of fever is noteworthy : as HARDYMENT has observed in a recent review of the subject, it is quite possible for a newborn baby to sicken and die having shown no more clinical disturbance than a vague lack of " being just right ".(1)

Recent emphasis on sepsis neonatorum in the temperate zone has received impetus from the emergence of highly pathogenic, antibiotic resistant staphylococci, often type 80/81, which have produced devastating outbreaks of disease in various age-groups, including the neonatal period.

Although outbreaks of this sort do not appear to be documented in the tropics, it is of interest to note that recent bacteriological studies in East Africa have shown that 97 per cent of type 80 staphylococci isolated in Uganda were resistant to penicillin,(2) so that it is apparent that this problem is rapidly becoming world-wide.

If, then, resistant virulent staphylococci are tending to spread all over the world, it is important for those concerned with the care of the newborn in tropical regions to try to avoid the situations which appear to be, in part at least, associated with epidemic neonatal staphylococci disease. In particular the avoidance of crowded newborn nurseries and the use of " rooming-in " techniques require stress ; while the short stays in hospital and the high degree of success of breast-feeding in lower socio-economic group mothers in the tropics both would seem to be factors tending to minimize the risk of what seems, unfortunately, to be principally a hospital-disease.

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CORRESPONDENCE

To the Editor

SIR,—May I be allowed to add some comments to the paper by Drs. GRIFFEL and WINTER which appeared in the June 1958 issue ? Rickets is a disease of the growing child. In cases of malnutrition, mostly we have no rickets at all. Today, after the introduction of antibiotics, mortality has much declined, especially of the well-nourished child and certainly in Israel. So that today, post-mortem examinations are a poor means of statistical evaluation of rickets.

Rickets affects different parts of the osseous system according to the age (in the first year : the forehead and the thorax, and in the second year : the legs) and in relation to accompanying disease, such as bronchitis in which the costochondral junction may be affected. A well-developed costochondral junction *per se* is no proof of freedom from rickets.

I do not think that the paper by Drs. GRIFFEL and WINTER give us any proof—either positive or negative—concerning the prevalence of rickets in a subtropical region in general or in Israel specifically.

Yours etc.,
A. ROSENBAUM.

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CALCIUM AND PHOSPHORUS METABOLISM IN MALNUTRITION AND IN KWASHIORKOR

by

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(with the Technical assistance of H. Martin)

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In a previous paper, we have described the calcium and phosphorus metabolism in "healthy" African boys (Holemans and Lambrechts, 1958) and have shown the potential depletion of populations living on low mineral diets. We were interested to know if malnutrition and kwashiorkor, which are rather common in this area, have a deleterious effect on mineral metabolism, particularly since it is known that in these diseases the digestive processes are impaired. (Holemans and Lambrechts 1955 ; Hansen, 1956 ; Robinson et al, 1957).

Most studies concerning the minerals in kwashiorkor and malnutrition deal with sodium and potassium metabolism (Hansen and Brock, 1954 ; Frontali, 1956 ; Heller and Schnieden, 1955 ; Hansen, 1956). No extensive studies seem to have been made on calcium and phosphorus metabolism in these conditions. A preliminary report of our results was presented to the 8th International Congress of Pediatrics in Copenhagen (Holemans, Lambrechts and Martin, 1956).

Methods

Twenty-nine balance studies, covering a total of 87 days, were performed on 19 subjects, 16 children and 3 adults, suffering either from typical kwashiorkor (11 cases, listed as "K") or severe malnutrition (8 cases, listed as "M") whose nitrogen and fat metabolism has been described in a previous paper (Holemans and Lambrechts, 1955) This paper should be consulted for details on patients and diets. The calcium and phosphorus intakes differed widely from one person to another because of the composition of the diet and large variations in appetite. In foods, stools and urine, calcium and phosphorus were determined after dry ashing by the Kramer and Tisdall method (1921) and the Briggs, Bell and Doisy (1922) method respectively.

The results for calcium and phosphorus are shown in Table I. Individual results represent the arithmetical means of the 3 separate days

For ease of comparison with "healthy" children the retentions at different levels of calcium and phosphorus intake of the present series of children have been plotted on Figs 1 and 2 which are reproduced from the previous paper (Holemans and Lambrechts, 1958) It will be seen that the majority of the results fall within the area of the average retention — or —2 standard deviations as determined by us (1958) for healthy children of the same district It is clear therefore that no major alteration in calcium and phosphorus metabolism takes place in severe malnutrition and in kwashiorkor

The greatest variation in retention occurs at intakes near the minimum requirement, particularly for calcium Therefore more negative calcium retentions are recorded in kwashiorkor than in healthy children

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[*] We wish to thank Dr. E. M. Widdowson for the translation of the manuscript and for her kind suggestions and criticisms

[†] Fonds Reine Elisabeth d' Assistance Medicale aux Indigènes

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DISCUSSION

Unjustified criticism has been made by PASSMORE (1956) on the ethical aspect of our nitrogen and fat balances in kwashiorkor. As this paper deals with the same subjects, we emphasize again the fact, mentioned before, that the intakes differed widely, but have not been reduced for experimental purposes. The low intakes of calcium and nitrogen were brought about by the severe and persistent anorexia of some patients. Although most of our diets contained little or no milk (because this food is very often refused by African children with poor appetite), they do contain meat, dried fish and vegetable protein (HOLEMANS and LAMBRECHTS, 1957).

As a rule we obtained positive retentions when the intakes of calcium were 22 mg./kg./24h, and of phosphorus above 30 mg./kg./24h. ; on the other hand, negative balances were found for calcium intakes of 18 mg./kg./24h. or less, and for phosphorus intakes of 27 mg./kg./24h. The minimum requirement in protein deficiency seems to be about

TABLE I. Calcium and Phophorus balances in Kwashiorkor and Malnutrition.

Calcium					Phosphorus		Ca/P in diet
Case No. and Diagnosis	Weight kg.)	Intake (mg./kg./ 24h.)	Apparent absorpton (% intake)	Retention mg./kg./ 24h.)	Intake (mg./kg./ 24h.)	Retention (mg./kg./ 24h.)	
(a) Children on low intakes.							
13 K	10	9.6	37	3	17.3	7	0.55
24 M	10	18	50	8	30	3	0.60
26 M	15.5	13	50	5	20	2	0.64
28 K	12.8	20	22	1.5	20	3	1.04
34 K	12.8	37	41	13	34	20	1.05
36 K	10.4	46	63	28	45	25	1
40 K	10.4	35	60	20	57	33	0.60
37 M	12.8	17	16	2	17	0	1
15 K	13.8	8.8	60	5	27	24	0.74
17 K	8.5	56	61	31	45	26	1.22
19 M	12	31	67	18	54	30	0.56
20 M	10	26	58	13.5	35	17	0.74
30 K	10.4	44	60	25	36	22	1.22
25 M	15.8	12	—	–13	24	–15	0.50
27 M	14	17	—	–35	30	–18	0.55
31 K	12.8	15	—	0	25	8	0.60
41 K	12.8	29	—	– 8	46	10	0.63
(b) Adults on low intakes.							
14 K	30	7	44	3	30	24	0.23
32 K	22	8.3	—	–12	16	– 3	0.53
29 K	22	14	23	0.2	15	4	0.96
39 K	22	15	—	– 9	25	1	0.61
38 K	38	16.5	11	1	15	0	1.09
35 K	22	20	28	3.5	20	4	1.03
(c) Children on high intakes.							
10 K	4.4	89	37	32	77	42	1.15
11 M	45	173	42	60	145	110	1.18
12 K	4.5	190	68.5	127	174	94	1.08
9 K	4.5	193	56	106	167	96	1.16
16 K	4.5	272	62	162	252	194	1.08
8 K	4	314	40	121	256	136	1.23

20 mg. of calcium and about 28 mg. of phosphorus per kg. body weight per 24h. These values are somewhat higher than the corresponding values we observed in " healthy " children (12 mg. for calcium and 21 mg. for phosphorus). The difference may be explained by the impaired intestinal function and the mild steatorrhoea existing in kwashiorkor. This disease causes no other disturbances of calcium and phosphorus metabolism detectable by short period balances. Our experiments give no information about the growth

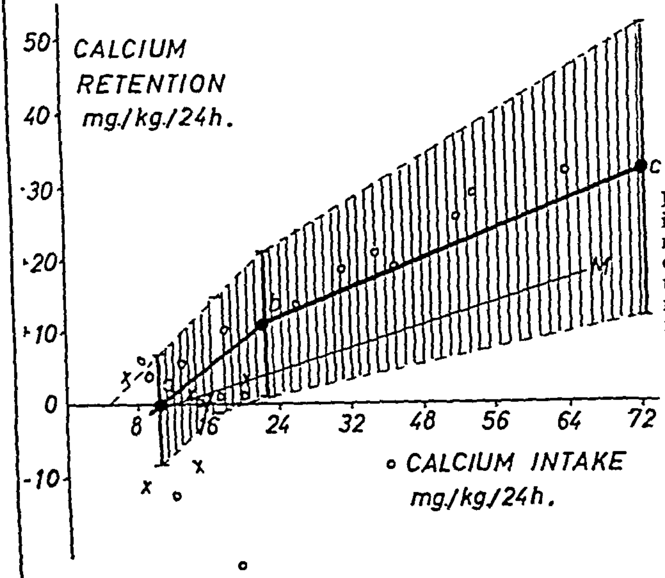

FIG. 1. Calcium retention and intake in kwashiorkor and severe malnutrition. (O = values for children. X = for adults. The thick line and the hatched area represent mean values and spread in " healthy " African children (HOLEMANS et al., 1958).

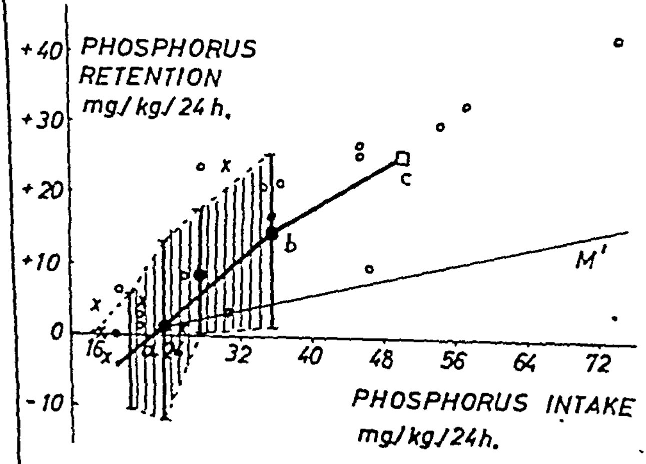

FIG. 2. Phosphorus retention and intake in kwashiorkor and severe malnutrition. (O = values for children. X = for adults. The thick line and the hatched area represent mean values and spread for " healthy " African children (HOLEMANS et al., 1958).

of the skeleton, upon which kwashiorkor has an influence as demonstrated by JONES and DEAN (1956).

CONCLUSIONS

Balance studies indicate that kwashiorkor has no specific injurious effect on calcium and phosphorus economy of children (absorption, retention, excretion) as compared with the calcium and phosphorus metabolism of " healthy " African children. The *minimum maintenance* requirement appeared to be somewhat higher in kwashiorkor and malnutrition.

SUMMARY

Twenty-nine calcium and phosphorus balances were performed on 19 subjects (16 children and 3 adults) suffering from kwashiorkor (11 cases) and severe malnutrition (8 cases). The relation between intakes and retentions of calcium and phosphorus is the same as observed in " healthy " children of the same area (Kwango). The minimum maintenance requirements for calcium and phosphorus are slightly higher (20 mg. of calcium and 28 mg. of phosphorus) than those we established for the healthy controls (12 mg. of calcium and 21 mg. of phosphorus per kg/24h.)

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EXCERPTS

HAEMOPHILIA IN JAMAICA

(WALTER, D. C., MCNEIL-SMITH, E. and WYNTER, L. *West Ind. med. J.*, **7**, 1).

Three cases of haemophilia occurring in Jamaican children of predominantly negro ancestry are presented with clinical and haematological data. Investigations with the thromboplastin generation test leave no doubt that these are *bona fide* haemophiliacs. Despite the few cases of haemophilia described in coloured populations, it is felt that the incidence of the disease in these racial groups is much higher than had been thought.

DIARRHOEAL DISEASE WITH SPECIAL REFERENCE TO THE AMERICAS

(VERHOESTRAETE, L. J. and PUFFER, R. R. *Bull W.H.O.*, 1958, **19**, 23).

This article presents data on morbidity and mortality from diarrhoeal disease in infancy and childhood for certain areas of the Americas. The role of the principal etiological agents is discussed, and the importance of various factors, such as availability of water-supply, fly control, malnutrition, and the protective effect of breast-feeding, is evaluated. Some practical measures for the prevention of deaths from diarrhoea are put forward, with special reference to early rehydration.

DATA ON SCHOOL HEALTH SERVICES IN GONDAR, ETHIOPIA

by

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The following data were collected from a school health service in Gondar, Ethiopia, over a period of three years and may add some details to the present knowledge concerning the health and growth of African school children.

BACKGROUND

Ethiopia, the only kingdom in Africa never colonized, has a population of about 20 million. It was isolated until very recent times because of special geological, religious and historical features. She has developed over a period of more than 2,000 years a quite independent indigenous civilization with periods of outstanding development of culture and fine arts. From 1632 until 1854, the capital of Ethiopia was Gondar. It is now a town inhabited by about 15,000 residents ; it has a limited water supply and electricity, and a sewage system for very few of the houses. Its position at an altitude of 2,000 to 2,300 metres, with its climate of " permanent spring ", is most favourable, as, indeed, in most parts of the country. So that the health situation in Ethiopia, unlike that in many other parts of the continent, forms a good background for raising the general standard of life.

Health services in Ethiopia, apart from the work of untrained local medicine-men, were started 60 years ago, and since then have been carried out by foreign physicians. Today's standard has been slightly raised by the employment of 7 Ethiopian, and 200 foreign physicians, and the establishment of 54 hospitals, with a total capacity of about 5,000 beds. For several years now Ethiopians have been sent abroad for studies, up to now 20 being in the field of medicine. Seven of them have returned after graduating as fully qualified physicians.

Vital statistics deducible from the registration of births and deaths are not available in Ethiopia as yet. Morbidity statistics collected from hospitals, private doctors and dresser-stations are not always reliable.

Teaching through the centuries has been conducted by the churches, mainly the Coptic Christian, as since 335 A.D. this faith has been the State religion : while Moslem priests have carried out educational duties for the Mohammedans of the kingdom. The pagans previously had no literate training. Up to the present some pre-school training is given to most Ethiopian children by priests in about 10,000 churches.

Secular elementary education started in Ethiopia in 1905, but has become a country-wide organized service only since 1941. In 1947, the " London Matriculation Examination " was adopted under the tutorship of the British Council. In 1954, according to the 1954 Guide Book of Ethiopia, there were 515 schools with about 66,000 male and 11,000 female pupils. In 1956, 130,000 pupils were enrolled. The total of new enrolments is increasing year by year. The number is restricted only by the limited facilities, not by lack of interest amongst the population. The money apportioned to the Ministry of Education is 16 per cent of the national budget, whilst the Ministry of Public Health uses 4 per cent.

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SCHOOL HEALTH SERVICES

Since 1941, school health services have been established throughout the country. The services are administrated by the Ministry of Education, carried out by trained school health dressers and supervised by a few foreign physicians on full—or part-time duties. These supervisors concentrate their efforts in the capital, Addis Ababa, and in Asmara, the capital of Eritea, which has now become federated. School dressers are employed in all larger schools, also in rural districts ; the total number is about 80. The budget of the school health services amounts to E$150,000 (equal to U.S. $60,000 or £20,000).

As most Ethiopian children are not fortunate enough to have the care of a family doctor or a polyclinic, the school health services are obliged to undertake curative services. For example, the budget provided for medicaments for more than 50 schools with about 8,000 pupils in the Begemidir Province, of which Gondar is the capital, amounts to E$6,000 per year (equalling US $2,400 or £850). Treatment in the schools is free of charge. These school health services are an important health factor in the country, as in most districts there seems to be no common knowledge of the causes and symptoms of diseases, and their possible treatment. Apart from the school health services, medical care is scarce or non-existent in rural districts, and there is little private cash available to the farmers and shepherds of the country, which could be spent on medical care, even if physicians and pharmacies were available.

Because of this, at the moment and probably for many years to come, health services will have to be organized and maintained by the State. Within this framework of nationalized health services, school health services may be regarded as a first step toward promotion of health, as by far more pupils are furnished with school facilities than with health services outside their schools.

Gondar plays an outstanding role in school health services, because of the presence of the "*Haile Selassie I Public Health College and Training Centre*". In 1952, the World Health Organization, soon after the establishment of the Eastern Mediterranean Regional Office, suggested the building of a training college for auxiliary health personnel, in order to attempt to meet the immediate needs of the country in a comparatively short time. It was also decided to concentrate on preventive rather than on curative medicine, as it appeared that most of the prevalent diseases could be approached by improving sanitation, vector-control, health-education, immunization and personal hygiene.

With the assistance of the United States Point IV Plan, UNICEF and WHO, the Haile Selassie I Public Health College and Training Centre, Gondar was founded in 1954 by the Imperial Ethiopian Government, as the first and only institution for the training of health officers (3 years training), community nurses (2 years training) and sanitarians (1 year's training). Each group will furnish about 20 graduates each year. In addition to this training, all three categories work one year under close supervision (the "internship year") after their graduation.

With the kind cooperation of the Ministry of Education, the school health services in Gondar were used as a training field for the health officer and community nurse student groups. Thus, careful medical examination of school pupils could be carried out and the well-equipped laboratory of the college could be used for tests. In this way, the health care for Gondar pupils improved considerably compared with that in other provinces, and its work may prove more valuable than those in many countries with a technically advanced health service.

Every pupil in Gondar undergoes the following examinations : (i) general examination : at least once (the aim is three during school attendance), including weight and height measurement, under close supervision of a pediatrician: (ii) urine examination (sugar and albumin); (iii) stool examination (ova and cysts); (iv) haemoglobin ; (v) serological test for syphilis (Kahn, VDRL) : (vi) occasionally preliminary examination in special fields (trachoma, leprosy, dental care, skin disease) carried out by specialists.

For treatment, if this is necessary, the pupils are referred to the school health dresser or to the outpatient department of the Gondar hospital. For deficiencies, UNICEF milk and vitamin capsules can be distributed on the supervisors' advice. School health examinations also included all kitchen workers in the boarding schools, who were also treated if necessary.

Health education was given in the secondary school six times weekly, for a full period of 40 minutes by the college students under close supervision. Some meetings were held with the teachers for discussion of special problems and to secure their cooperation and participation. The goal of self-direction of health behaviour was set as an ideal to teachers and pupils.

The data collected from 3,390 pupils (at present about 2,500 attending schools in Gondar) may give a general picture of the health situation of a great number of children of this age-group in Gondar. Probably more than half of the children between 7 and 15 years in Gondar attend school.

RESULTS

The writer's general impression is that the pupils in Gondar are in good health and in the higher grades are in modest but fair nutritional condition apart from some diseases due to lack of hygiene, health education and sanitation, with the exception of the high incidence of positive tests for syphilis.

(1) *Weights in comparison to heights.* It is universally recognized that exact measures of nutritional status are very difficult to define. Anyhow measurement of weights and their comparison with heights regardless of age are the only possible way in Gondar of gaining an average weight graph, as birth dates are not known. Significant alterations in growth can only be determined if, and when, standards indicating normal development in the population concerned are available. Such standards are probably given now for Gondar with the figures collected. They are included in the accompanying graphs (Figs. 1 and 2) compared with figures from the U.S.A. and Germany. But it has to be borne in mind, however, that the Ethiopians are racially a mixture of Cushites, (who immigrated from Egypt between 3000-1000 B.C.), Semites (who immigrated from Southern Arabia about 1000 B.C.), and one or more unknown native groups, together with some other African races. They are mostly fineboned and leptosome : obesity is very rarely seen. Because of these racial characteristics probably the average weight related to height will always be less in adults and children than in some nations of Europe or the U.S.A.

It has to be noted that it is the writer's impression that the age of U.S. children and German children in the same height group is lower than that of Ethiopian children. This impression can only be confirmed as correct if, and when, birth certificates are employed in the future.

A programme of increased distribution of UNICEF milk may give proof within

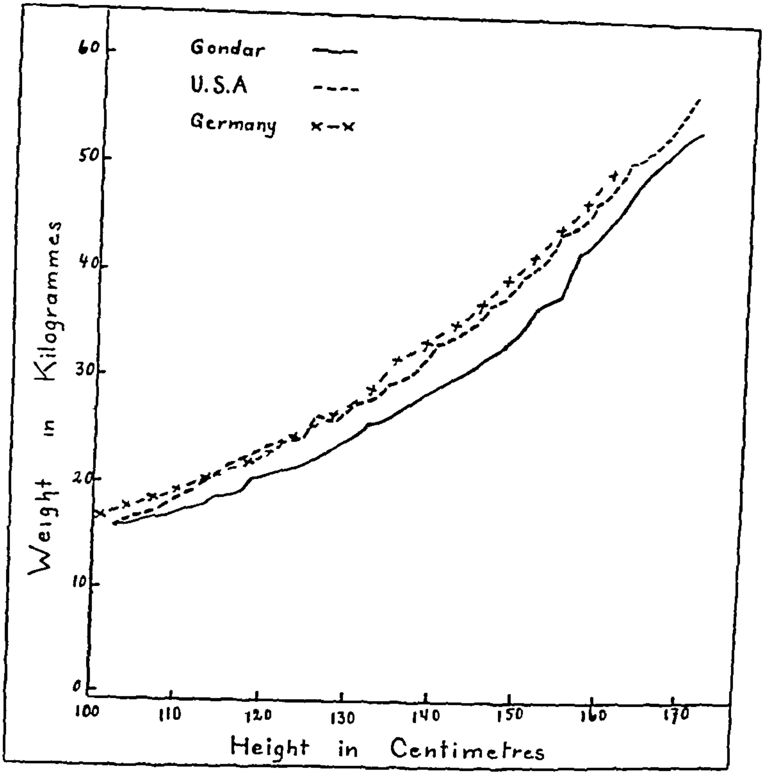


FIG. 1. Weight/Height growth curves of Ethiopian schoolboys in Gondar compared with U.S.A. and German figures.

the coming years as to whether or not the average weight related to height can be increased ; although, of course, such possible results may not necessarily indicate that the present average weight is a sign of undernourishment. Protein requirements may well vary between populations and it has been established that different peoples can live in apparent good health on protein intakes far below the standards commonly set by physiologists. In such nations, an increase of protein might or might not be necessarily an advantage.

The population in Gondar is usually almost self-sufficient with respect to food production. The common dishes in well-to-do and in poor families are *injera* and *wat*. *Injera* is soft, unsalted leaf-bread. It is prepared from *teff* (*Eragrostis abyssinica*) ground to a flour, fermented with water for 24 hours and then baked for 5 to 6 minutes in a clay dish. It is about 50 cm. in diameter and 1/2 cm. thick, and tastes like ryebread. *Wat* is a sauce composed of legumes, including horsebeans, chickpeas, kidneybeans, and lentils pounded to a flour, and mixed with spices. First *berbere* (red pepper) is dried and ground, then mixed with onions and butter, thus forming a thick cream. Then the legumes are added, and, sometimes boiled eggs, chicken meat, potatoes and tomatoes. Also cow's or goat's meat may be included. The taste is varied with ginger, mustard seed or garlic. Very few families are ready to buy vegetables or fruit, or grow them in their gardens. (One of the reasons for this may be the difficulty in obtaining enough water in the homes). Bananas, oranges, papaya and peaches have been cultivated for many years, and lemons, grapes and figs have existed for centuries. Various trees and shrubs grow wild, including briar roses, coffee and sycamores.

The diet of the Ethiopian Christian population is highly influenced by the fasting periods, as for 150 days of the year no kind of animal-product is allowed, including meat, milk, eggs and butter. Fish is allowed, but is rarely obtainable. In some districts, fish also falls under these fasting regulations. The children from 7 years up are included in the fast, but even the smaller ones indirectly " fast " with the family, as usually no special dish is prepared for them. The longest uninterrupted fasting period lasts for about 2 months.

Milk is available to about a quarter of the families in Gondar. It was found that the number of cattle owned stood in no relation either to the consumption of milk or its availability. Livestock in Ethiopia seem to be regarded mainly as a wealth, in fact a " meat fortune ", not as a source of milk. Cattle are mostly herded on grazing grounds far from the owner's lodge. Lack of facilities for transportation of the milk is an important factor. Such milk as may be had in town is relatively expensive. In Gondar one litre of cow's milk costs about E$0.30-0.50 (12-20 U.S. cents) ; only rarely does milk seem to be used to prepare sour milk or cheese. The main milk product is butter, which is largely used in local meals. According to the information kindly supplied by FAO and the Ministry of Agriculture in 1958 there was an estimated 23,505,000 head of cattle in the country in the year of 1957. The cattle are almost wild and, as the writer was informed locally, the average output of milk after calving is from one to two litres daily for some months after. Goats and sheep are not kept for milking purposes. Camels and buffalo do not exist in the Gondar region. Information concerning other districts

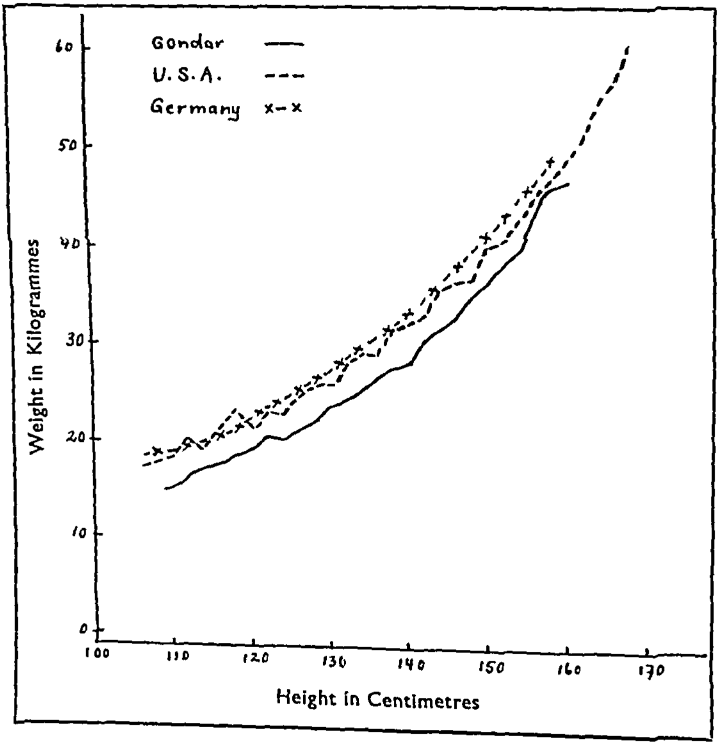
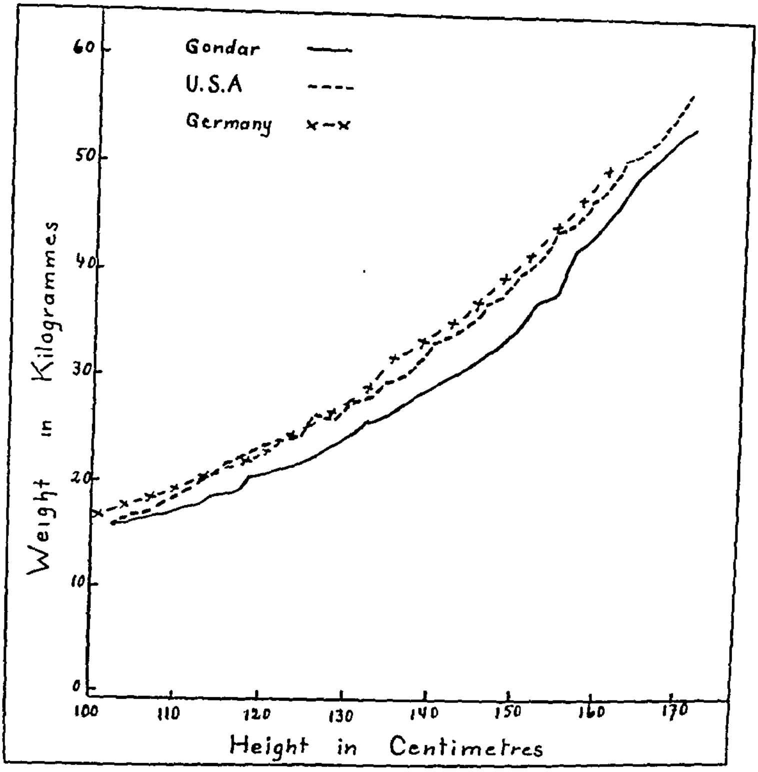


FIG. 2. Weight/Height growth curves of Ethiopian schoolgirls in Gondar compared with U.S.A. and German figures.



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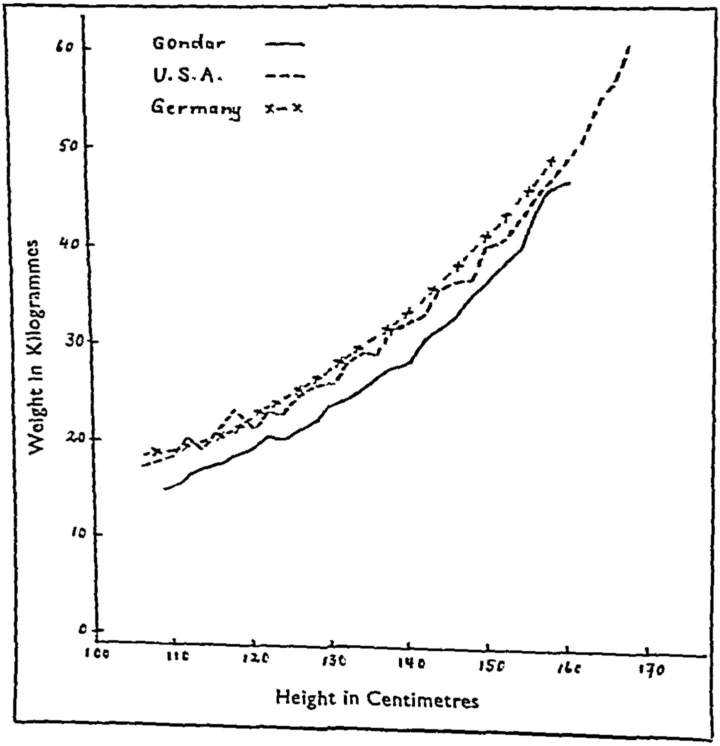

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is not available. The ownership of cattle seems to be a sign of wealth only. Only well-to-do families and those of higher education seem to consume milk.

(2) *Posture.* No fixed postural abnormalities were seen except a few due to accidents. Small school girls often showed a flexible lordosis, which is also common in other countries during the pre-school age.

(3) *Speech disturbances.* They seemed to be rare. Stuttering exists, but is uncommon.

(4) *Hearing disturbances.* These were probably mostly due to chronic otitis and destruction of the eardrum. In these cases, only special seating arrangements could be advised.

(5) *Eye disease.* Trachoma was found in a preliminary survey by a specialist (Professor GUERRA of Asmara) in 75 per cent of the school children. This figure coincides approximately with the average found in some other parts of the country, and indicates the general prevalence among all pupils in Gondar.

From the detailed stages of the trachoma findings, it can be concluded that trachoma is probably commonly contracted during infancy or early childhood and shows a healing tendency during the age of school attendance. Thus, trachoma appears in Gondar in a comparatively mild form. Serious complications apart from opacities of the cornea are very rare. Blindness due to trachoma was not observed in these school children Out of 300 unselected pupils :—

9 (3.9%) (7 boys ; 2 girls) had Trachoma I (f +)
26 (11.3%) (11 boys ; 15 girls) had Trachoma II (f +)
33 (14.3%) (18 boys ; 15 girls) had Trachoma II (p +)
112 (48.4%) (93 boys ; 19 girls) had Trachoma III (f +)
27 (11.7%) (8 boys ; 19 girls) had Trachoma III (p +)
22 (9.5%) (15 boys ; 7 girls) had Trachoma IV (c +)
2 (0.9%) (1 boy ; 1 girl) had Trachoma IV (c ++)

Staphylomata of one eye were seen in about 3 per cent of the pupils, probably due to previous spring conjunctivitis and other severe infections. Conjunctivitis other than that caused by trachoma and spring conjunctivitis is also very common, obviously changing with seasonal conditions.

(6) *Vision disturbances.* Only special seating arrangements could be advised for these pupils as eyeglasses are not available in Gondar, except for very few children. It is the writer's opinion that many vision disturbances are due to irregularities of the surface of the cornea because of trachoma scars.

(7) *Ears, nose, mouth.* These diseases were noted only when of major importance. It is the writer's impression that common colds, enlarged tonsils, adenoids and stomatitis are comparatively rarer than in Europe, as, for example, in Germany. Otitis, acute and chronic, seems to be common.

(8) *Teeth.* The following findings during a preliminary survey of a specialist (H. C. WORCESTER, U.S. Major, Dentist, Asmara) are typical for the school children in Gondar.

Age groups	5-9 years	10-16 years
No. of children	105	100
Sound	84 (80%)	74 (74%)
Carious teeth	21 (20%)	26 (26%)
Paradontal conditions	35 (33%)	26 (26%)

Cleaning of teeth with a stick of special wood is common in Gondar and seems to be an effective form of dental care. The general impression is that children who say that they are using these sticks regularly seem to be in a fairly good dental condition compared with these who neglect to use this method.

(9) *Skin Leprosy*. In a preliminary survey (Dr. LAVORIN, WHO, and Dr. SCHALLER, Director of the Leprosarium at Addis), it was found that 1-1.5 per cent of Ethiopian population is leprous. No cases amongst school children in Gondar were confirmed bacteriologically, although 8 children were found to be suspicious clinically. The distribution of leprosy cases seems to vary in the provinces. Out of the 150,000 to 200,000 lepers in Ethiopia, only a few thousand are isolated and some 30,000 are under medical care. In Gondar, 1,000 are under treatment.

Scabies was found in a third of the younger pupils, none in older school children. The cases found in school children were mostly not severe.

Impetigo is common as a complication of scabies and appears also as a disease on its own. The slight cases were not recorded statistically, as they can be regarded as a minor feature mostly of short duration. *Keloids* seem to be more common than for example in Germany, and also scars resulting from burns in early childhood ; slight cases of *fungus diseases* of the skin are not uncommon.

(10) *Lymph nodes.* Swollen lymph glands are common usually as a result of various skin infections.

(11) *Heart.* There was not a single case of congenital or acquired heart disease. Accidental heart murmurs seem to be rare. Some cases of arrythmia were found with no other associated upset.

(12) *Lungs.* Any complaints or abnormal findings were referred to the X-ray department of the Gondar Hospital. No case of active tuberculosis was found. Mantoux testing of school children was not done during the period of this report. Certainly tuberculosis in adults is a common disease in Ethiopia, as reported by both the hospital and polyclinic.

(13) *Abdomen.* Very often the abdomen is distended in the younger age groups, and pains are commonly reported by the children. Parasites and dietary faults may be responsible for these findings. In older age groups of pupils, these symptoms are rarer.

(14) *Spleen.* Some children with enlarged spleen were found. It should be mentioned that malaria is very rare in Gondar, which is at about 2,300 metres altitude, and that the occurrence of kala-azar has been confirmed in the hospital, but seems to be uncommon.

(15) *Liver.* No cases with enlarged liver were found, and jaundice seems to be comparatively rare amongst school children.

(16) *Hernia.* Umbilical hernias seem to be more common than in Europe ; inguinal hernias seem to be rarer. Incomplete descent of the testicles was observed in a few cases.

(17) *Bones, joints, muscles.* As mentioned. most Ethiopians have fine and well-formed bones. Sporting activities are coming more and more into fashion and competitive games are enjoyed on most Sundays in Gondar. Deformities from previous rickets were not seen. Tuberculosis of the bones, including the spine. was not observed in school children in Gondar, but reported by the polyclinic and field services. Deformities were noted resulting from accidents with poor setting of fractured bones.

(18) *Reflexes.* Patellar and Achilles tendon reflexes were absent astonishingly often. No reason can be given. All other reflexes seemed normal.

(19) *Stool examination.* There is a high incidence of many different kinds of intestinal parasites, the most common being *A. lumbricoides.*

Out of 1,773 stool tests for ova, cysts and parasites, 1,168 (65.9%) were positive. In the positive children 38.7 per cent had more than one parasite (Table I)

(20) *Urine examination.* Only one case of diabetes was found. In some children, albuminuria was present, but no serious kidney disease was diagnosed.

(21) *Haemoglobin.* This was tested with the Sahli haemoglobinometer and results are given in Table II.

TABLE I. Intestinal parasites in 1,168 positive stool tests in Ethiopian school children.

Species	Positive	
	No.	%
Ascaris lumbricoides	919	56.7
Trichuris trichiura	318	19.6
Entamoeba histolytica	228	14.1
Taenia saginata	38	2.3
Strongyloides stercoralis	35	2.2
Ankylostoma duodenale	28	1.7
Entamoeba coli	21	1.3
Lamblia giardia	13	0.8
Schistosoma mansoni	10	—
Hymenolopis nama	6	—
Enterobius vermicularis	4	—

TABLE II. Haemoglobin levels in 1,817 Ethiopian school children.

Haemoglobin (Sahli %)	Boys (1,580)		Girls (237)	
	No.	% total boys	No.	% total girls
50	3	—	—	—
55	7	—	—	—
60	45	2.9	—	—
65	30	1.9	2	—
70	195	12.3	3	1.3
75	92	5.8	13	5.5
80	336	21.3	47	19.8
85	127	8.0	44	18.6
90	346	21.9	48	20.2
95	85	5.4	39	16.5
100	314	19.9	41	17.5

(22) *Venereal diseases.* The tests carried out were the Kahn and VDRL. The results were regarded as significant, if the Kahn and VDRL were positive, or if one of the two tests was positive, but not if VDRL was " weakly positive " and Kahn negative. The results showed that 126 (8.2 per cent) of 1,352 school children were positive. Analysis showed no sex difference—8.1 per cent of 1,322 boys, and 9 per cent of 210 girls. Out of 409 secondary school boys, 9.3 per cent were positive.

This comparatively high prevalence is most probably due to some cases of acquired syphilis in the older age-groups, while the positive findings in the younger children are most probably the result of congenital syphilis.

It may be mentioned that a preliminary survey of 987 unselected mothers attending the MCH services in Gondar showed 46.6 per cent to have positive serological tests for syphilis, while 50 per cent confirmed having been infected with syphilis previously. According to the clinical findings in adults there can be little doubt, that the majority of positive Kahn and VDRL tests in school children are, in fact, due to syphilis and are not false positive due to nonspecific diseases.

Only one case of gonorrhoea was found amongst school children.

(23) *Nutritional deficiencies.* Minor forms of rickets are common in early infancy, but severe signs of previous rickets in school children were not found. Distinct signs of deficiencies of other vitamins could not be discovered for sure amongst school children. The general appearance of some pupils gave the impression of protein deficiency and undernourishment, but neither many nor severe cases of this kind were seen.

(24) *Other diseases.* Scarlet fever, diphtheria, smallpox, rubella, food-poisoning, brucellosis, yellow fever have not been observed either amongst school children or otherwise in Gondar during the period of observation (Autumn 1954 to April 1958).

No cases of filariasis, tetanus, rabies, malaria, epidemic encephalitis, chorea, typhoid fever, typhus, noma, or stones of the urinary bladder were seen in school pupils, but these diseases certainly exist in Gondar in adults, as well as in children, as has been reported by the polyclinic and the hospital. Goitre is common in some districts nearby, but has not been observed in school children in Gondar.

One smallpox epidemic was reported from a remote district more than 100 km. away from Gondar. Some immunizations against smallpox are usually done by dressers and other personnel in early infancy throughout the country.

One epidemic of measles was observed amongst pre-school children. No cases in children were seen during school health services. Probably the population of Gondar normally acquires natural, active immunity by contracting the disease during early childhood or infancy. The same applies to whooping cough.

A few pupils with weakness of some muscle groups were suspected of having had poliomyelitis. A few cases of the disease were observed amongst pre-school children not covered by the school health services, one of whom had paralysis of both legs. No acute cases were reported amongst school children. It is also the writer's impression that immunity to poliomyelitis is commonly contracted during early infancy.

One school pupil in Gondar is a chondrodystrophic dwarf. Epilepsy was seen once in a school ; but the disease is not uncommon, according to reports from the polyclinic and hospital. Other convulsions were neither seen nor reported during school attendance. Nose-bleeding was seen several times in pupils.

Poisoning from *kosso* (*Hagenia abyssinica*) was observed during pre-school children both in the MCH clinic and hospital, and some of these resulted in death. It seems to be a habit to administer self-collected flowers from the *kosso* tree for " cleaning the intestines " of tapeworms. No poisoning was seen or reported amongst school children during the period of observation.

Foreign bodies in the nose, ears and throat are common, as are insects, such as flies or bedbugs, especially in the ears. Injuries from traffic accidents were not seen or reported. Other injuries, such as from stone-throwing or falling from a tree, seem to be not uncommon, as usual amongst school children anywhere. Ectoparasites, such as lice, fleas, bedbugs and jiggers (*Tunga penetrans*) were found especially among school girls and in the homes on the occasion of home-visits.

It seems doubtful if children affected with severe illness or their consequences would come to school at all, and, although some home-visiting was done, often no history could be gained of children who had left schools permanently ahead of time, or for a long period, or who never entered school because of their health condition.

CUSTOMS IN CHILDHOOD

Usually boys are circumcised in their first weeks of life. This rite is performed by older men or priests. In some cases, part of the glans had been injured. Sometimes, however, circumcision is carried out when they are much older. Circumcision of female infants, as is habitual in some tribes, usually seems to consist in the removal of the clitoris or of part of it.

Several days after birth, the uvula or part of it is removed. An indigenous medicine-man severs it with a wire-loop, which is passed through a bamboo-stick. It is said that the uvula obstructs the breathing, affects the voice, and interferes with swallowing. Nearly all school children in Gondar, therefore, have no uvula.

In most children, the canines are extracted on their appearance. Surprisingly often it was noted by school health workers that children had displaced teeth. Tonsillotomy is also often performed in a primitive manner by medicine-men. Infections have been seen, but not in the school health services.

COMMENTS

Although a physical examination without a history is inadequate, the health history of each pupil is mostly impossible to obtain. In a careful study, it was found that 36 different names of diseases appear to be existent in the main Ethiopian languages and dialects. One may conclude that this number of diseases can be distinguished by the population. Among these were whooping cough, measles, smallpox, chicken-pox, diarrhoea, syphilis and scabies.

It was possible only in a very few cases to find out previous diseases of school pupils by questioning. If and when pupils registered in the school were not attending the school either temporarily or permanently. it usually was impossible to find out the reasons. Therefore all facts reported in this paper are based only on findings during presence in schools.

To the writer the most impressive feature is how much improvement in cleanliness, nourishment and health can be observed in the higher grades of the schools. It is, therefore, likely that school education is a most important factor for raising the standard of health. In Gondar, and most probably in the whole of Ethiopia, the school is usually of much greater importance for health education than the parent's home can be. Schools in Ethiopia seem more than in many other countries to give an unparallelled opportunity for spreading health knowledge and teaching of sanitation practices.

LYSINE IN THE TREATMENT OF PROTEIN MALNUTRITION

by

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It has been reported that on certain low protein diets, the addition of a small amount of lysine will improve the nitrogen balance of experimental animals (Rosenberg and Culick, 1957). In fact, it has been reported, although not confirmed, that infants also improve when given a small amount of lysine in addition to their usual diet (Albanese et al., 1955).

There have been numerous accounts of childhood protein malnutrition in Bombay (Patel et al., 1957), and its treatment (Lewis et al., 1956). In this study mostly cases of kwashiorkor have been included, together with a few children with marasmus. The children were placed either in a control group, or were treated with small supplements of lysine.

Although lysine is present in moderate amounts in milk, it is relatively deficient in rice and vegetable proteins, so that the diet of these children, certainly deficient in protein, might also have contained an especially low amount of lysine.

METHODS

Some 18 cases of protein malnutrition among infants were selected for this study. They all showed wasting and oedema, or wasting, or oedema with associated features. All of the children were admitted to the Hospital and alternate cases were put in the control group. All of them were given the usual hospital diet for young children. Half of the cases were given 500 mg. lysine daily for six weeks. This was administered twice a day, after the morning and evening meals.

Weights were recorded and serum proteins were estimated both at the end of three weeks and again at six weeks, as well as the start of the study. A Mantoux test was performed and none of the children with a positive reaction was included. Cases of chronic infection were also excluded, although diarrhoea was common at the time of admission and during the period of observation. One case had to be removed from the series because of the onset of measles. Many of the children were given vitamin A and D, while a few received vitamin C or B complex.

Blood was obtained by venepuncture and placed in a dry tube. The serum was separated for chemical study. The specific gravity was measured with copper sulphate and the total proteins calculated. The protein fractions were separated by electrophoresis (Jenks et al, 1955) and the percentage of each fraction determined by staining and elution.

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RESULTS

Although these children were in poor condition and four of them had a serum albumin of less than 1 g./100 ml. of serum, there were only four deaths in the series, two in the control group and two in those receiving lysine.

Reference to Tables I a and b indicates that diarrhoea, oedema, skin changes, xerosis,

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TABLE Ia. Clinical data of children on hospital diet.

Case No.	Diarrhoea	Oedema	Skin Change	Hair Change	Xerosis (eye)	Hepat.	Miscell.	Diagnosis
1	+	++	+					Kwashiorkor
2		+	+	+	+			Kwashiorkor
3		++	+		+	+		Kwashiorkor
4		+		+	+			Kwashiorkor
5	+	++	+				Drowsiness	Kwashiorkor
6	+		+			+	Anaemia, Stomatitis	Kwashiorkor
7			+		+		Emaciation	Marasmus
8	+	+++	++	+		++	Fever, Stomatitis	Kwashiorkor

TABLE Ib. Clinical data on children on hospital diet plus lysine.

Case No.	Diarrhoea	Odeema	Skin Change	Hair Change	Xerosis (Eye)	Hepat.	Miscell.	Diagnosis
9	+	++	+				Purpura	Kwashiorkor
10	+	+			+		Bitot's Spots	Kwashiorkor
11		+++	+	+				Kwashiorkor
12	+		+				Fever, Stomatitis, emaciation, Apathy	Marasmus
13	+		+	+			Anaemia, Fever, Emaciation	
14	+	++	+			++	Anorexia	Kwashiorkor
15		+	+	+		+		Kwashiorkor
16		++			+		Ascites, Rickets	Kwashiorkor
17	+	++	+	+			Ascites, Stomatitis,	Kwashiorkor

TABLE IIa. Weight in lbs. of children on hospital diet.

Case No.	Inital Wt.	wt. at 3 wks	Wt. at 6 wks.	Wt. gain in last 3 wks.
1	17	20	21	1
2	20½	22	25	3
3	25½	25½	31½	6
4	16	18	—	—
5	25	26½	32	5½
6	26	26	—	—
7	11½	12½	13½	1
8	16	13	16	3
Average	18.9	20.4	23.2	3.2

depigmentation of hair, and hepatomegaly were common in both series. Anaemia, emaciation and stomatitis were also noted.

During the first three weeks, some of the children gained weight and some lost weight due to the mobilization and excretion of oedema fluid. There was not much difference in the weight record of the controls and the lysine treated group during this period (Tables II a and b). However, during the second three weeks, all of the controls gained weight, and the average was 3.2 lb. ; while in the lysine treated group two infants remained more or less stationary and one lost a considerable amount, so that the average weight change was a gain of only 1.3 lbs.

The changes in serum protein level at 3 weeks and at 6 weeks as well as the difference between the level at the beginning and at 6 weeks are given in Tables III a and b. There was a marked rise in albumin and total protein, and a fall in gamma globulin. There was also a slight rise in the beta globulins. The serum albumin and the total proteins did not rise as rapidly, or as much, in the lysine treated group as in the controls. The finding which is most interesting is the serum albumin level at 3 weeks, when the lysine treated group only rose 0.54 g. per cent.

It was also the opinion of the clinicians that those infants which received the lysine did not fare as well generally as those in the control group.

TABLE IIb. Weights in lbs of children on hospital diet plus lysine.

Case No.	Initial Wt.	Wt. at 3 wks.	Wt. at 6 wks.	Weight gain in last 3 wks
9	22	20½	24	3½
10	22	20	20	0
11	14	15	17	2
12	14	15	13	–2
13	20	22½	24	1½
14	14	13	—	—
15	17½	21½	21	– ½
16	16	14½	17	3½
17	19	20	23½	3½
18	19½	25	—	—
Average	17.8	18.7	19.9	1.3

TABLE IIIa. Average serum protein levels (g./100 ml.) in children on hospital diet.

	Total protein	Albumin	Alpha 1 globulin	Alpha 2 globulin	Beta globulin	Gamma globulin
Initial	4.04	1.33	0.30	0.45	0.57	1.52
Std. Dev.	.90	.48	.06	.07	.16	.32
Std. Error	.32	.16	.02	.02	.05	.10
3 weeks	5.25	2.36	0.30	0.64	0.77	1.12
Std. Dev.	.35	.42	.07	.10	.08	.28
Std. Error	.13	.15	.03	.04	.03	.10
6 weeks	5.30	2.43	0.30	0.66	0.72	1.14
Std. Dev.	.46	.19	.08	.12	.12	.51
Std. Error	.16	.07	.03	.04	.04	.18
Change	1.26	1.10	0.00	0.21	0.15	–.38
Std. Dev.	1.01	.52	.11	.14	.20	.60
Std. Error	.36	.18	.04	.05	.07	.21

TABLE IIIb. Average serum protein levels (g./100 ml.) of children on hospital diet plus lysine.

	Total protein	Albumin	Alpha 1 globulin	Alpha 2 globulin	Beta globulin	Gamma globulin
Initial	4.50	1.50	0.32	.058	0.65	1.33
Std. Dev.	.75	.49	.07	.16	.17	.44
Std. Error	.23	.15	.02	.05	.05	.14
3 weeks	5.00	2.04	0.30	0.62	0.70	1.33
Std. Dev.	.68	.55	.05	.14	.15	.33
Std. Error	.21	.18	.02	.05	.05	.10
6 weeks	5.30	2.44	0.27	0.63	0.75	1.13
Std. Dev.	.30	.41	.05	.14	.07	.17
Std. Error	.09	.12	.02	.04	.02	.05
Change	0.80	0.94	-.05	0.05	0.20	-.20
Std. Dev.	.81	.64	.09	.22	.18	.47
Std. Error	.25	.19	.03	.06	.05	.15

DISCUSSION

Although it is obvious from the weight records and the serum protein figures that lysine had no favourable effect upon the course of these children, it is not so easy to determine to what extent it delayed the expected recovery.

Feeding of a disproportionate amount of a single amino acid is known to have adverse effects upon protein utilization as shown in animal experiments (ELVEHJEM and HARPER, 1955). It would seem that the human may be no exception to this general rule and that supplementation of the diet with a single amino acid must be undertaken with caution and scepticism.

In previous studies it has been shown that the addition of 25 mg. per day of chlortetracycline does have a beneficial effect upon the course of protein malnutrition (LEWIS et al., 1956), and this would certainly be more therapeutically beneficial than supplementation with a single amino acid.

SUMMARY

The addition of 500 mg. lysine daily to the diet of infants with protein malnutrition has no beneficial effect and may delay the progress of recovery on suitable dietary regimes.

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THALASSAEMIA IN SOUTH INDIA

by

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In April 1956, two children with classical thalassaemia came to us and aroused our interest in this condition. We had understood that this type of anaemia was limited to people of Mediterranean origin and were therefore surprised to find it in Mysore. Since then we have heard of other cases being seen in this city (now included in this report) and in other parts of India.

Thalassaemia (originally termed Cooley's anaemia) was first described in Italian children by Cooley and Lee in 1925. Since then cases have been reported from many parts of the world as follows : England (Bywaters, 1938) ; China (Foster, 1940 ; Wang and Khoo, 1940 ; DeMarsh, 1950) ; Germany (Fredenbergh and Esser, 1942) ; Spain (Jaso et al., 1942) ; Egypt (Silver, 1950) ; Mexico (Silver, 1950) ; Thailand (Minnick et al., 1954) ; and India (Das Gupta et al., 1954 ; Ganguli and Lahiri, 1955).

We now report five further cases in children seen by our colleagues, Dr. P. D. Krishnaswamy and Dr. S. Narayana Shetty and ourselves, in Mysore City during 1956.

Thalassaemia is due to an inherited defect of the erythron with inability to synthesise adult haemoglobin, so foetal haemoglobin persists. This results in recognisable abnormalities in the blood smear. The severity of the condition varies from patient to patient, the milder forms (thalassaemia minor) probably being due to the heterozygous arrangement of the gene ; this type is recognisable only by careful blood examination. The more severe form (thalassaemia major) is seen mainly in children, because death occurs early and probably results from a homozygous distribution of the gene. In this latter type widespread somatic changes are seen.

CLINICAL PICTURE

The main clinical features of thalassaemia major may be summarised as follows :

(1) *Growth retardation.*

(2) *Facial appearance.* Characteristically, this is mongoloid from the abnormal thickening of the facial bones. The skull sometimes feels abnormal to palpation owing to thickening of the inner and outer tables. The complexion is yellowish or muddy.

(3) *Pallor and lassitude* are due to anaemia.

(4) *Enlargement of liver and spleen* are usual : enlargement of lymph glands sometimes occurs.

(5) *Radiological changes* may occur in the skull and long bones, due to hyperplasia of the bone marrow. The skull shows thickening of the vault and spicules of bone are seen radiating out from the inner table. The long bones show thinning of the cortex and sometimes spontaneous fractures.

(6) *Haematology.* The red cells are thin (the opposite of those found in congenital haemolytic anaemia) and sometimes oval in shape. A proportion of the red cells show the target deformity (Mexican hat cells) in which an intermediate paler zone lies between denser inner and outer areas. In many red cells punctate basophilia is seen. Normoblasts are often present in great numbers, indicating an effort on the part of

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the bone marrow at increased blood regeneration. Osmotic fragility of the red cells is decreased, but mechanical fragility increased. A distinctive pattern is found on electrophoresis in the severer cases, but difficult to demonstrate as adult and foetal haemoglobin have similar mobilities. However, alkali denaturation can be used to differentiate these two types.

(7) *Prognosis.* The anaemia responds to no known form of treatment and is progressive. Death usually occurs from anaemia or intercurrent infection. Blood transfusions may be of temporary benefit.

CASE REPORT

CASE I

A female Hindu child, aged 4½ years, complained that she felt dizzy. She was the second child, the first having died with " a lump in the groin " at the age of 3 months, while the third is described below. Her mother and maternal grandmother were said to be anaemic. This child had been born by normal delivery at home, she sat at 8months, talked at 12 months and walked at 18 months.

On examination, she was a short, underdeveloped child (height 34″, weight 26 lbs.) with a rather ugly face, eyes widely separated and a sallow complexion. The circumference of head was increased (20½″). The heart was not clinically enlarged, but a haemic murmur was heard. Harrison's sulcus was present. The lungs were normal. The liver and spleen were each enlarged downwards by two fingers-breadth. A few lymph glands were slightly enlarged in the posterior triangles of the neck, the right axilla and the right groin. The spine and wrists appeared normal. Gargoylism was suspected.

Laboratory investigations. Hb. (Sahli) 40% ; R.B.C. 2.4 million/cu.mm. ; colour index = 0.8 ; P.C.V. 23% ; many erythrocytes showed punctate basophilia, hypochromia, microcytosis ; target cells 3% ; normoblasts 2%. Leucocytes 11,000/cu.mm. (neutrophils 36%, lymphocytes 64%). Erythrocyte fragility : initial haemolysis in 0.42% saline, complete in 0.36 % saline : E.S.R. (Wintrobe) 10 mm. in first hour ; quantitative van den Bergh 12 units ; Kahn negative ; blood cholesterol 100 mg.%.

Radiological examination. The skull showed changes typical of thalassaemia ; the dorso-lumbar spine was normal.

CASE II

A male Hindu child, aged 2 years, the brother of Case I. His mother said he was " weak " ; he had had a recent attack of diarrhoea. He had sat at one year and had walked at 18 months : he was not yet able to speak when he came to us.

On examination, the child was backward and underdeveloped (height 31″, weight 16 lbs.). He had a large head (circumference 19¼″). Harrison's sulcus was present. Heart and lungs were normal. The liver edge was just palpable. The lymph glands were slightly enlarged in all the superficial groups.

Laboratory investigations. Hb. (Sahli) 56% ; R.B.C. 3.1 mill./cu.mm., colour index = 0.9 ; P.C.V. 33% ; many erythrocytes showed punctate basophilia, hypochromia and microcytosis ; target cells 4%, normoblasts 2%. Leucocytes 17,650/cu.mm. (neutrophils 48%, lymphocytes 50%, monocytes 2%). E.S.R. (Wintrobe) 1 mm. in first hour.

Radiological examination. The skull skiagram was poor owing to technical difficulties. The wrist showed no rickets.

Progress. Oral iron was started and some improvement was noted in the first 2 weeks, probably due to coexisting iron deficiency. These children have not been seen since.

CASE II(a)

This adult woman was the mother of Cases I and II. She said that she had suffered from anaemia for the last 3 years. On examination, some pallor was noted, but no other abnormality. Blood examination showed Hb. 52% (Sahli) and target cells 2% ; there was no basophilic stippling of the erythrocytes. It is presumed that this patient has thalassaemia minor. Her husband's blood showed no abnormality on ordinary examination.

CASE III

A female Hindu child, aged 9 years, was admitted in May, 1956 after sustaining a supracondylar fracture of her left arm during a fall. It was noticed that she was very anaemic. She was the first child of the family and 2 subsequent children were alive and well, but not examined by us.

On examination, we found pallor, marked bossing of the skull, enlargement of the liver by 2 fingers breadth and some enlargement of the lymph glands in the right supraclavicular area and the left groin.

Laboratory investigations. On admission, Hb. (Sahli) 17%. She was treated with oral iron and further blood investigations were done when the Hb. had risen to 40% and the child had been referred for medical opinion. R.B.C. 3.5 mill./cu.mm. : colour index = 0.5 ; P.C.V. 30% : leucocytes 6,700/cu.mm. (neutrophils 34%, lymphocytes 62%, eosinophils 2%). Erythrocytes showed hypochromia, anisocytosis, polychromasia and poikilocytosis : no target cells were seen. E.S.R. (Wintrobe) 17 mm. in 1st hour.

Radiological examination. The skull showed typical changes, the spiculation being very well seen. The left elbow showed no bony changes apart from the fracture.

Progress. Within one month from the time of admission the Hb. had risen to 52% on oral iron therapy. She was then discharged against advice and not seen again. It is noteworthy that in this case the anaemia responded to iron therapy. The skull x-ray abnormality is the only apparent diagnostic feature.

CASE IV

A female Hindu child aged 12 years, was brought by her parents with a history of extreme weakness, breathlessness, and general swelling of the body for one month. She had had similar complaints frequently for the previous 10 years, treated by liver extract injections and diuretics. A younger sister had died at the age of 7 years with similar complaints, and a younger brother and 2 younger sisters were suffering from anaemia and general ill-health.

On examination this child had a mongoloid facies and her growth was stunted ; her skin had a yellowish tinge. The liver and spleen were both enlarged down to the umbilicus and ascites was present. There was oedema of the feet.

Laboratory investigations. Hb. 22% ; R.B.C. 1.65 mill./cu.mm. There were numerous normoblasts, target cells and ovalocytes ; anisocytosis and poikilocytosis were also present. Leucocytes 16,400/cu.mm. W.R. negative.

Radiological examination. The vault of the skull showed thickening of the inner and outer diploe and there was a very marked sun-ray appearance of spiculation. The long bones showed coarse trabeculation of the shaft with areas of osteoporosis giving a rather moth-eaten appearance.

Progress. This child has since died.

CASE V

A male Muslim child, aged 6 years. He had mongoloid facies and typical bony changes, the pelvis and ribs showing changes similar to those in the long bones.

Laboratory investigations. The blood count was similar to those described above, but is not available in detail.

DISCUSSION

Haemoglobinopathies are now being recognised and reported from many parts of the world. Thalassaemia has been found in peoples who have no obvious or recent connection with the Mediterranean area. SIDDOO et al. (1950) who described thalassaemia minor in the Sikh community in Vancouver, Canada, have suggested that a large pool of the thalassaemia gene at one time existed in the Mediterranean basin and perhaps spread to Italy, Greece, Syria, Kurdisthan, India, Thailand and China, countries which lie along the routes of early migration of races. This is a problem for the geneticists. It would seem, therefore, that this condition may be found in any country and the possibility of its occurrence should be borne in mind whenever one is called to make a diagnosis in a case of moderate or severe anaemia in childhood.

Iron deficiency is common in South India and it would appear that the improvement seen in Cases II and III was due to this complicating factor. Thalassaemic patients do not respond to iron therapy — the serum iron is already high and haemosiderosis occurs.

The presence of target or Mexican hat cells in a peripheral blood smear is common in the haemoglobinopathies, but as far as we are aware the bony changes found in the cases described have not been reported in the other types.

In retrospect, it is regrettable that electrophoretic studies of the blood were not available when these patients were seen. According to the agreed international system for the terminology of haemoglobinopathies, the combination A + F found at any age after infancy indicates thalassaemia.

SUMMARY

Five cases of thalassaemia major are reported from Mysore State, S. India. The worldwide distribution of this condition is emphasised.

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THE EFFECT OF CAROB FLOUR SUPPLEMENTS ON THE ABSORPTION OF NITROGEN BY KWASHIORKOR PATIENTS

by

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Carob flour, an anti-diarrhoeic agent prepared from the fruit of the carob tree (*Ceratonia siliqua*), is widely used in the treatment of diarrhoeal disorders. In paediatric practice it is usually prescribed in strengths of from 5 to 10 per cent. either in water or mixed with the feeds. The anti-diarrhoeic properties of carob flour have been attributed to its high content of lignin, a substance which is said to have high adsorptive and hygroscopic powers (MARTIN DU PAN, 1945a). As a result of this quality it is said to absorb fluid and toxic substances in the intestinal tract and in addition, the bulky bolus formed is said to slow down peristalsis (MARTIN DU PAN, 1945b).

Most authors are agreed on the value of carob flour in promoting the passage of formed stools and reducing the number of motions passed in infantile diarrhoea (SMITH and FISCHER, 1949 ; KEYSER and MANDERS, 1949 ; PLOWRIGHT, 1951 ; ABELLA, 1952 ; FORTIER, et al, 1953). WALKER (1952), however, concluded that carob flour does not significantly alter the course of diarrhoea or the concomitant loss of stool fluid.

PRETORIUS and SMIT (1957) used carob flour in the treatment of the diarrhoea of kwashiorkor. Although the addition of carob flour to skimmed milk was found to promote the passage of formed stools, this effect did not take place rapidly and, even in the third week after the commencement of dietary therapy, only 55 per cent. of the stools passed by the patients who received skimmed milk with added carob flour were formed. In the same investigation balance studies suggested that carob flour supplements may cause impairment in the absorption of nitrogen. The object of the present paper is to present further evidence on this property of carob flour.

MATERIAL AND METHODS

Metabolic Studies. A total of 15 nitrogen balance studies were performed on 8 male patients with either acute or convalescent kwashiorkor. The age of the patients varied between one and two years. The balance period was in each case three days. Dietary treatment consisted of fresh skimmed milk with an addition of either 6.5 per cent. carob flour or 5 per cent. dextrimaltose so that both formulae provided about 15 calories per fluid ounce. The quantity of skimmed milk prescribed was approximately 2½ oz. per lb. bodyweight per day.

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TABLE I. Nitrogen Balance Results.

Case	Commencement of balance study	Diet	Weight (kg.)	Calories /kg./day day	Nitrogen Intake mg./kg./ day	Urinary Excretion of Nitrogen mg./kg./ day	Faecal Excretion of Nitrogen mg./kg./ day	Total Nitrogen Excretion mg./kg/. day	Nitrogen Retention mg./kg./ day	% Nitrogen retention	% Nitrogen absorption
1	Day following admission	Skimmed milk + 6.5% carob flour	5.8	36	379	125	170	295	84	22	55
1	10 days after admission	,,	5.8	95	954	422	355	777	177	19	63
2	Day following admission	,,	7.8	68	727	175	313	488	239	33	57
3	14 days after admission	,,	8.2	84	883	509	312	821	62	7	65
4	Day following admission	Skimmed milk + 5% dextrimaltose	8.3	72	576	143	127	270	306	53	78
5	Day following admission	,,	6.4	77	751	93	145	238	513	68	81
6	Day following admission	,,	9.3	73	702	168	131	299	403	57	82
7	Day following admission	,,	7.3	94	982	581	179	760	222	23	82
7	7 days after admission	,,	7.1	89	864	431	155	586	278	32	82

Four balances were performed on three patients with acute kwashiorkor while they were receiving the carob flour supplement, and five balance studies on a further four patients with the same condition who were receiving dextrimaltose instead of carob flour. In the case of the eighth patient, a case of convalescent kwashiorkor, 6 spot balances were carried out at weekly intervals using skimmed milk with carob flour and skimmed milk with dextrimaltose on alternate weeks. During the first four balance studies the patient had a high intake of protein, but during the last two the protein content of the formulae was halved by prescribing equal parts of skimmed milk and water. The caloric values of the 2 formulae (half-strength skimmed milk + 6.5 per cent. carob flour, and half-strength skimmed milk + 5 per cent. dextrimaltose) were increased by the addition to the formulae of 42 g. of soya oil. The oil was kept in suspension by adding gelatine at the rate of about 3 g. per 50 fl. oz. of formula and mixing the ingredients in a high speed electric blender. Each formula provided approximately 18 calories per fluid ounce.

Balance Technique. The technique, based on that of HANSEN (1956), was identical with that described previously (PRETORIUS and SMIT, 1957). Separate collections of urine and faeces were made over 3-day periods. Carmine was used to mark the faeces. Nitrogen in the food, faeces and urine was estimated by a modification of the macro-Kjeldahl method (LOUW, 1955).

Composition of Carob Flour. In this investigation, Nestle's " Arobon " was used. The percentage composition of the product as given by the manufacturers is as follows :—

Fat	1.5	Cellulose	6.0
Protein	4.5	Pectin	1.5
Soluble carbohydrates	45	Minerals	3.5
Lignin, hemi-cellulose, etc.	21	Moisture	3.5
Starch	13.5	Caloric value	75 Cal. per oz.

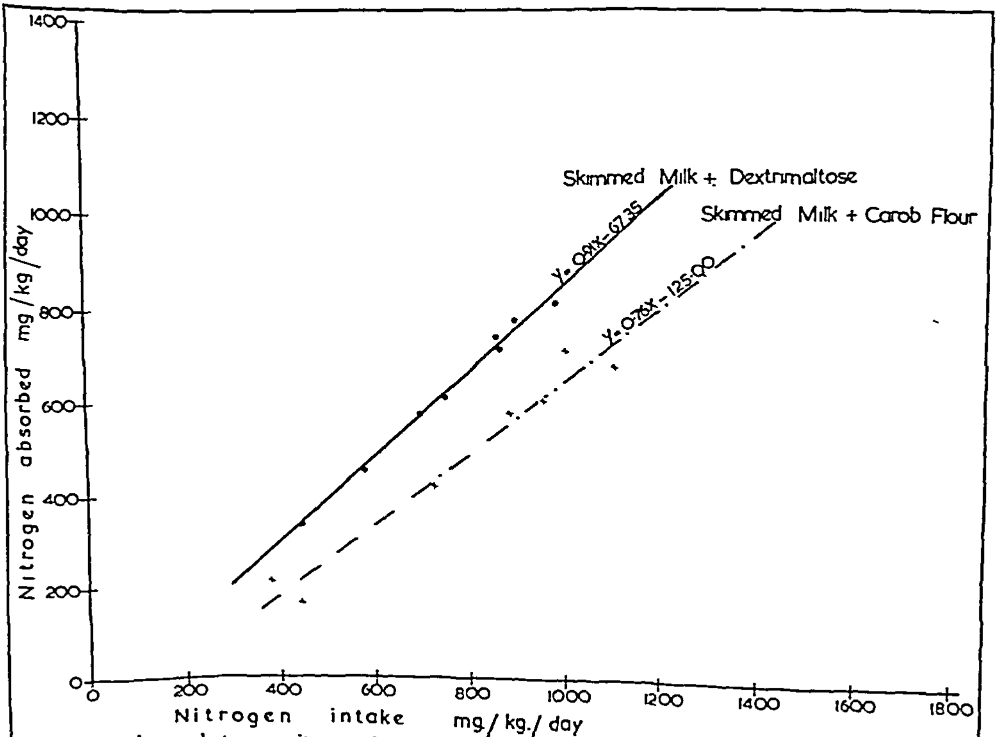

FIG. 1. Relation between nitrogen intake and nitrogen absorption in children with kwashiorkor receiving skimmed milk with carob flour and skimmed milk with dextrimaltose. The values are taken from Tables I and II.

TABLE II. Nitrogen balance results obtained in a " cured " patient without diarrhoea.

Commencement of Balance Study	Diet	Weieht (kg.)	Calories kg./ day	Nitrogen Intake mg./kg./ day	Urinary Excretion of Nitrogen mg./kg./ day	Faecal Excretion of Nitrogen mg./kg./ day	Total Nitrogen Excretion mg./kg./ day	Retention mg./kg./ day	% Nitrogen Retention	% Nitrogen Absorption
4 weeks after admission	Skimmed milk + carob flour	7.1	92	1001	421	298	719	282	28	70
5 weeks after admission	Skimmed milk + dextri-maltose	7.1	90	858	469	124	592	266	31	86
6 weeks after admission	Skimmed milk + carob flour	7.3	94	1102	493	435	928	174	16	61
7 weeks after admission	Skimmed milk + dextri-maltose	7.3	94	986	556	128	684	212	24	86
9 weeks after admission	Skimmed milk + soya oil + carob flour	7.8	100	448	242	285	527	-79	—	36
10 weeks after admission	Skimmed milk + extra water soya oil + dextri-maltose	8.2	95	445	337	106	443	2	0.5	76

RESULTS

The results of the balance studies are shown in Tables I and II and Figures 1-3. Those concerning acute kwashiorkor being given in Table I and Fig. 1 and 2, and those obtained in convalescent kwasiorkor in Table II and Figs. 1 and 3.

As can be seen from Fig. 1, the amount of nitrogen absorbed was appreciably lower when the formulae contained carob flour than when the carob flour supplement was replaced by dextrimaltose. A statistical test, using the standard error of regression, has shown that the regression line drawn through the values obtained with carob flour was significantly below the line for skimmed milk with dextrimaltose (Fig. 1). In both groups, however, the net amount of nitrogen absorbed increased proportionally with intake.

From Table I and Fig. 2 it can be seen that, during the early stages of treatment of kwashiorkor, the impairment in the absorption of nitrogen was aggravated when carob flour was added to skimmed milk, either in the presence or absence, of diarrhoea. Case No. 1 (Table I) had severe diarrhoea, not controlled by the carob flour, whilst case No. 2 developed diarrhoea soon after the commencement of dietary treatment. The third patient in this group (case No. 3), who also showed great impairment in his absorption of nitrogen, passed formed stools during the balance period. As can be seen from Fig. 2, the average percentage of the nitrogen intake absorbed by the patients who received

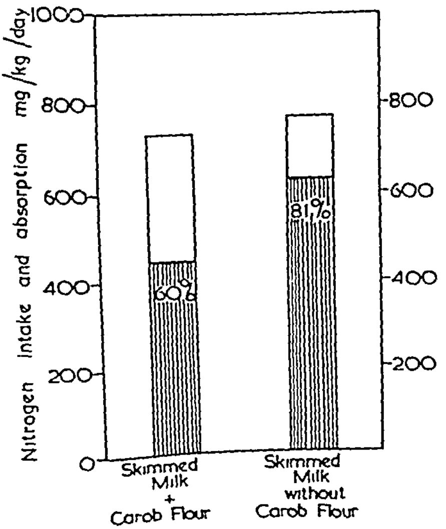

FIG. 2 Intake and absorption of nitrogen in patients with "acute" kwashiorkor on the two formulae. Height of column represents average intake and hatched area average absorption The values are taken from Table I.

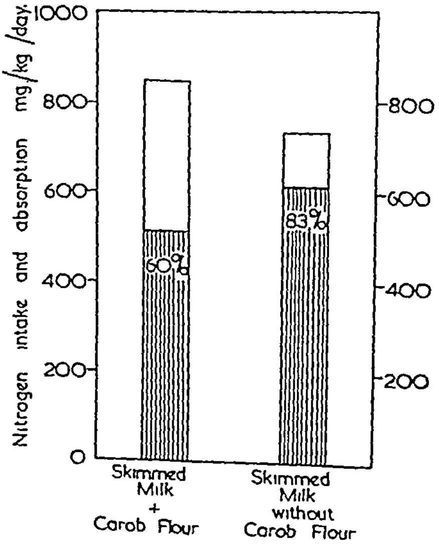

FIG. 3. Intake and absorption of nitrogen in a "cured" patient without diarrhoea on the two formulae. Height of column represents average intake and hatched area average absorption. The values are taken from Table II.

TABLE II. Nitrogen balance results obtained in a " cured " patient without diarrhoea.

Commencement of Balance Study	Diet	Weieht (kg.)	Calories kg./day	Nitrogen Intake mg./kg./day	Urinary Excretion of Nitrogen mg./kg./day	Faecal Excretion of Nitrogen mg./kg./day	Total Nitrogen Excretion mg./kg./day	Retention mg./kg./day	% Nitrogen Retention	% Nitrogen Absorption
4 weeks after admission	Skimmed milk + carob flour	7.1	92	1001	421	298	719	282	28	70
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protein malnutrition with intakes varying from 400 to 500 mg. per kg. per day (average 444 mg./kg./day). As can be seen from Tables I and II, much higher intakes of nitrogen were required to obtain comparable retention when carob flour was added to the feeds. It is apparent, therefore, that if carob flour is used for long periods, especially in the presence of protein malnutrition, the protein intake should be high. In the previous investigation (Pretorius and Smit, 1957) a 6.5 per cent. suspension of carob flour in skimmed milk was prescribed. The patients improved satisfactorily on a protein intake of about 5.7 g./kg./day. This quantity of protein, at any rate, was apparently sufficient, but even this amount may well prove to be inadequate if carob flour is prescribed in strengths of 10 per cent.

The percentage absorption of nitrogen in kwashiorkor is, in the experience of others (Holemans and Lambrechts, 1955; Hansen, 1956; Robinson *et al.*, 1957), as well as in our own, usually in the region of 80 per cent. a figure well above the average of 60 per cent. in the case of the patients who received the carob flour supplement (Fig. 2). The differences were even more pronounced in a case who had "recovered" from kwashiorkor and who had no diarrhoea (Fig. 3).

The high content of lignin in carob flour is probably responsible for the anti-diarrhoeic properties of carob flour (Martin du Pan, 1945). It is therefore possible that, as a result of the high absorptive and hygroscopic qualities of lignin, proteins or products of protein digestion are kept in "suspension" by carob flour in the intestinal tract. It is also possible that the faecal excretion of nitrogen is increased through a mechanical effect of carob flour on the intestinal mucosa, leading to an increase of "metabolic" nitrogen in the faeces. It is known that cellulose causes an increased excretion of faecal nitrogen in the rat (Meyer, 1956).

As far as we are aware, it is not known whether carob flour can impede absorption of other nutrients. It is said not to interfere with the absorption of chloromycetin, terramycin or aureomycin (Fradkin, 1953). It would also be of interest to know if other anti-diarrhoeic preparations can cause impairment in the absorption of protein or other nutrients. According to Fradkin (1953), kaolin mixtures impede the absorption of vitamins.

Since the consistency of the stools is not, at present, regarded as of such importance in the treatment of infantile diarrhoea as it used to be (Holt, 1956), it seems particularly desirable for information to be obtained about the effects of various anti-diarrhoeic substances on the absorption of nutrients.

Summary and Conclusions

Fifteen nitrogen balance studies were performed on 8 male patients suffering from kwashiorkor. Nine balances were done on 7 cases soon after admission and the remaining 6 balances on one patient with convalescent kwasiorkor. Dietary treatment consisted of skimmed milk supplemented with either 6.5 per cent. of carob flour or 5 per cent. dextrimaltose.

The amount of nitrogen absorbed from the formulae containing carob flour was significantly lower than the amount absorbed when the carob flour supplement was replaced by dextrimaltose.

In spite of the marked impairment in the absorption of nitrogen which occurred when the formulae contained carob flour, the net amounts of nitrogen retained were fairly high in the majority of patients who had protein intakes. On lower intakes, however, retention of nitrogen was poor resulting in a negative balance on one occasion.

the carob flour supplement was 60, whilst the corresponding percentage during 5 balance periods where the carob flour was relpaced by dextrimaltose was 81, even though all 4 patients receiving the latter supplement passed loose or watery stools.

The eight case (Table II) was studied after " initiation of cure, " as defined by BROCK *et al.*, (1955), had taken place. At this stage, no diarrhoea was present, the serum protein concentration and serum amylase activity had returned to " normal " and clinically the patient had reached the stage where he could, if necessary, be discharged from hospital.

As can be seen from Table II, on each occasion when carob flour was added to the feeds a considerable impairment in the absorption of nitrogen occurred. On every occasion when the carob flour was replaced by dextrimaltose there was a striking improvement in nitrogen absorption. When the nitrogen intake was high, considerable amounts of nitrogen were retained, despite the impairment in the absorption which occurred in the presence of carob flour. However, when the intake of nitrogen was reduced to 448 mg. per kg. bodyweight per day only 36 per cent. of the intake was absorbed, resulting in a negative nitrogen balance. When the carob flour supplement was replaced by dextrimaltose, a vast improvement in the absorption of nitrogen (76 per cent. of intake) occurred, although the intake was almost identical with the amount ingested during the previous balance period.

DISCUSSION

Carob flour is usually prescribed in the acute stage of infantile diarrhoea, and often only during the " starvation period " and for a few days thereafter. Under these circumstances impairment in the absorption of nitrogen is probably not important. It seems desirable to know, however, whether the impairment in the absorption of nitrogen is likely to prove deleterious to the patient if carob flour supplements are administered for prolonged periods, especially in the presence of protein malnutrition. FRADKIN (1953) used carob flour to good effect in the chronic diarrhoeas of adults, regardless of aetiology. The patients, however, received high protein diets. HUGH-JONES (1953) added carob flour to the diets of infants after the acute stage had passed in cases where diarrhoea persisted, particularly if the general condition was deteriorating or remaining stationary. No particulars with regard to the protein intake and the strengths of carob flour used, however, were given. The period of administration was apparently up to three weeks or more and no deleterious effects of carob flour were recorded. VONDERWEIDT and KLEIN (1955) also showed that strengths of 2 per cent. of carob flour could be administered for prolonged periods without causing adverse effects. PRETORIUS and SMIT (1957) used carob flour supplements at a strength of 6.5 per cent. for periods up to 4 weeks in the treatment of the diarrhoea of kwashiorkor. Clinically no adverse effects were noticed, but the patients were receiving high protein diets, the intake being approximately 5.7 g. of protein per kg. bodyweight per day.

The data in Tables I and II show that, in spite of an impairment in absorption, the amounts of nitrogen retained by the patients who received carob flour supplements were often considerable, when the intake of nitrogen was high. The nitrogen balance was negative, however, when the intake was reduced to 448 mg. of nitrogen per kg. bodyweight per day. This amount is equivalant to about 2.8 g. of protein per kg. per day, a figure very near the 3 g. per kg. per day usually regarded as the optimum amount required daily in childhood. HOLEMANS and LAMBRECHTS (1955) found an average retention of 265 mg. of nitrogen per kg. per day (60 per cent. of average intake) in 7 children with protein malnutrition with intakes varying from 400 to 500 mg. per kg. per day (average 444 mg./kg./day). As can be seen from Tables I and II, much higher intakes of nitrogen were required to obtain comparable retention when carob flour was added to the feeds. It is apparent, therefore, that if carob flour is used for long periods, especially in the presence of protein malnutrition, the protein intake should be high. In the previous investigation (Pretorius and Smit, 1957) a 6.5 per cent. suspension of carob flour in skimmed milk was prescribed. The patients improved satisfactorily on a protein intake of about 5.7 g./kg./day. This quantity of protein, at any rate, was apparently sufficient, but even this amount may well prove to be inadequate if carob flour is prescribed in strengths of 10 per cent.

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In spite of the marked impairment in the absorption of nitrogen which occurred when the formulae contained carob flour, the net amounts of nitrogen retained were fairly high in the majority of patients who had protein intakes. On lower intakes, however, retention of nitrogen was poor resulting in a negative balance on one occasion.

It is concluded that if carob flour supplements are given for prolonged periods, the protein content of the diet should be sufficiently high to counteract the effect of this substance on the absorption of nitrogen.

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BOOK REVIEWS

Diseases of Children in the Subtropics and Tropics. 1958. Edited by H. C. Trowell and D. B. Jelliffe. London : Edward Arnold. pp. 919. £5.5-od. ($19.50).

Up to the present time, no book attempting to deal with the problems of pediatrics in the tropics has been available, and one can certainly say that this publication covers an area previously almost untouched.

The editors have wisely gathered contributions from a large number of authorities who have had personal experience in the field of child health in widely scattered tropical countries, and, although this has broadened the scope of the contents, it has inevitably entailed a variable quality and perspective in the different sections, as well as occasional areas of over-lap.

These are, however, relatively minor criticisms, and the huge ill-defined field has been well covered. In particular, both "cosmopolitan" pediatric disease in the different geographic-climatic, cultural and socio-economic millieu of the tropics (as, for example, tuberculosis) and the exotic, mainly tropical diseases (such as malaria and leishmaniasis) have been dealt with.

Some sections seemed particularly valuable, especially those on preventive child health by Dr. Cicely Williams, on acute diarrhoea by Dr. Ortiz of Puerto Rico, on nutritional disease by Dr. Trowell and on intestinal helminths by Drs. Jung and Jelliffe.

This publication is handsomely produced and lavishly illustrated by a large number of clear illustrations. It can be strongly recommended for all working in preventive or curative pediatrics in the subtropics and tropics.

Symposium on Tuberculosis. 1957. Edited by F. R. G. Heaf. London : Cassell and Co. Ltd. pp. 755 £5-5-0d. ($15.90).

Tuberculosis is rapidly becoming a predominantly "tropical" disease, and nowadays, comprises one of the top five groups of diseases confronting the pediatrician working in tropical regions. This publication is then both timely and of real practical value for the child health worker.

While there are excellent sections, specifically on tuberculosis in children and on problems of tropical areas, in fact almost all the book is directly relevant to the tropical pediatrician. In particular, modern concepts of prevention and chemotherapy are fully discussed. As would be expected with the distinguished editor, methods of both BCG immunization and of tuberculin testing are very well covered, both in the text and in very clear photographs.

This publication appears to the reviewer to be quite the most useful book on tuberculosis now available. It is thoroughly recommended as a reference text on this wide, complex and increasingly important prob-